ARMKNECHT

OMAHA

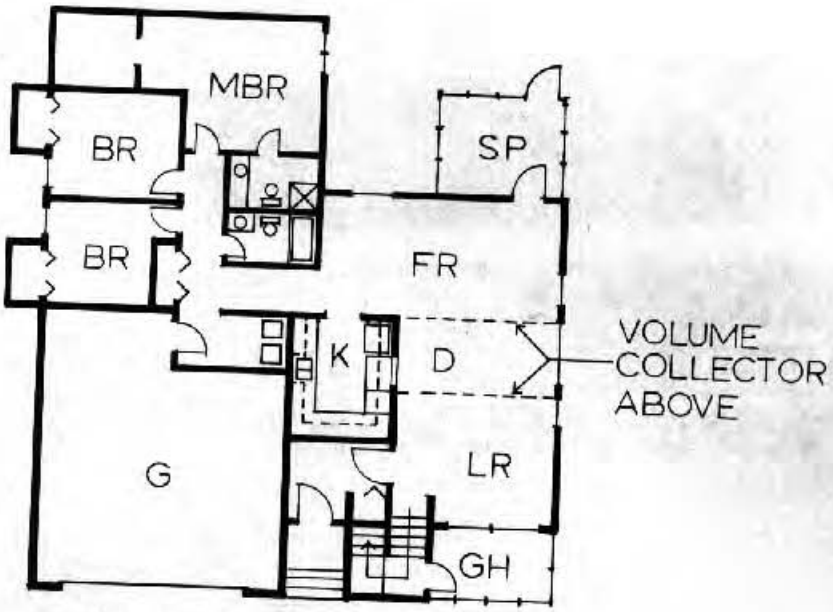
VOLUME COLLECTOR

The Armknecht home is a solar house that utilizes a volume collector with brickbed mass storage. The owner, an architect, was told that, because the lot faced south, he would be unable to design a solar house -- it would face the street. He successfully overcame the supposed obstacle. In addition, he used a hill behind his home to his advantage by planting windbreak vegetation (opposite right).

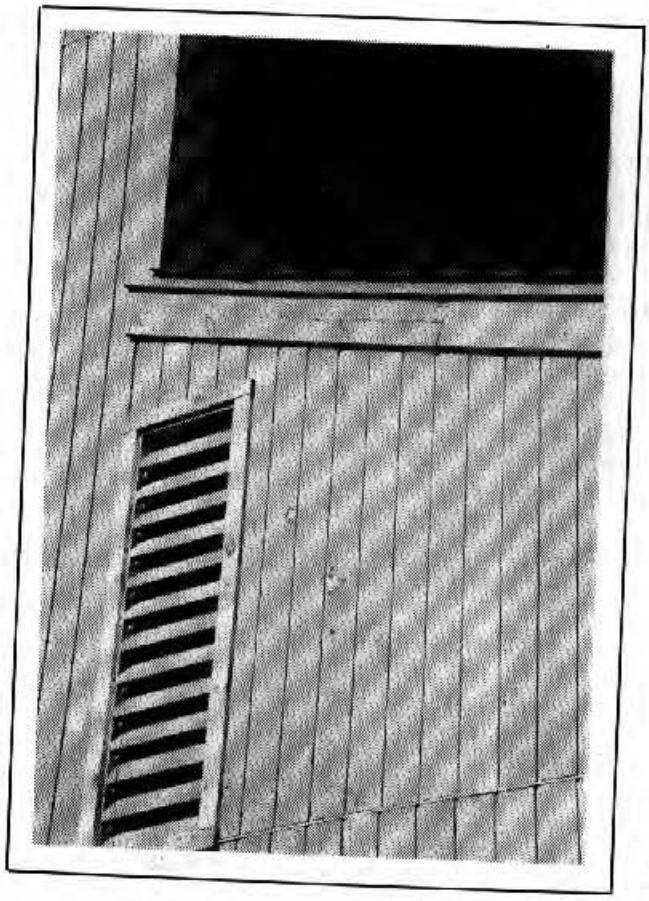
The volume collector is located in the attic space directly above the dining room. The collector surface has approximately 160 sq ft of vertical south facing glass. Ventilation panels (opposite left) on the side of the volume collector space permit ventilation of the collector area during the summer. During the heating season, hot air is ducted from the volume collector to a mass storage room in the basement. The 5 x 7 x 8 foot storage room is filled with loosely stacked factory reject bricks. The air return of the mechanical system in the house is routed through the brickbed to preheat air to the gas furnace.

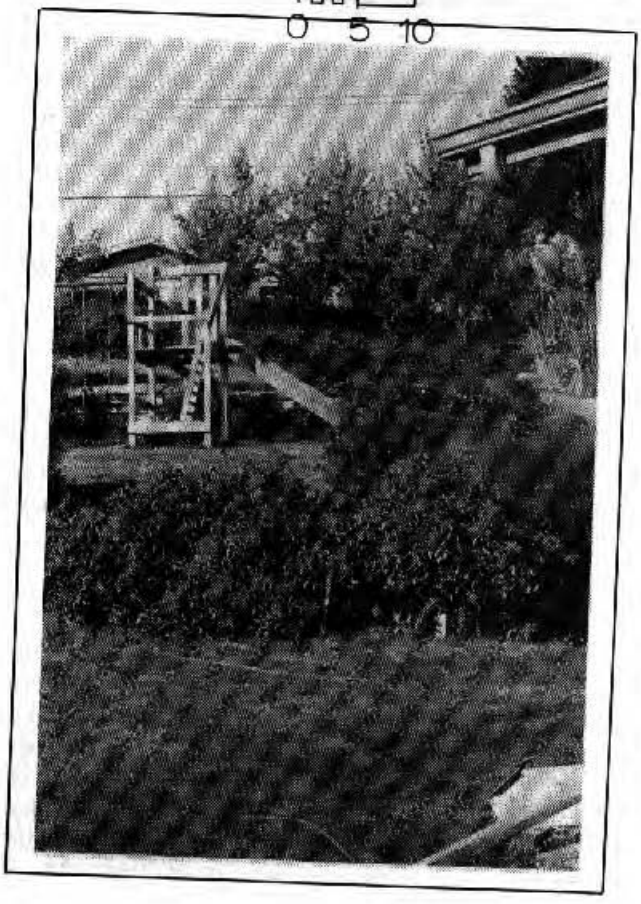
The owner has had problems with the volume collector system. For example, air leaks in the passageway between the volume collector and storage have caused heat loss. The owner also feels that the house has more mass than necessary because there are too many bricks in the brickbed storage. At the time of construction, however, there were few guides available to assist in sizing rockbeds/brickbeds. At present, access to the volume collector is limited by the location of a folding stair which makes the volume collector area unusable space, a situation the owner would correct were he to design it over. Despite problems, however, the TIF value for the Armknecht home, claculated from performance data, is 3.2.

A step down greenhouse to be located in front of the existing living room is planned for future construction.



MAIN LEVEL



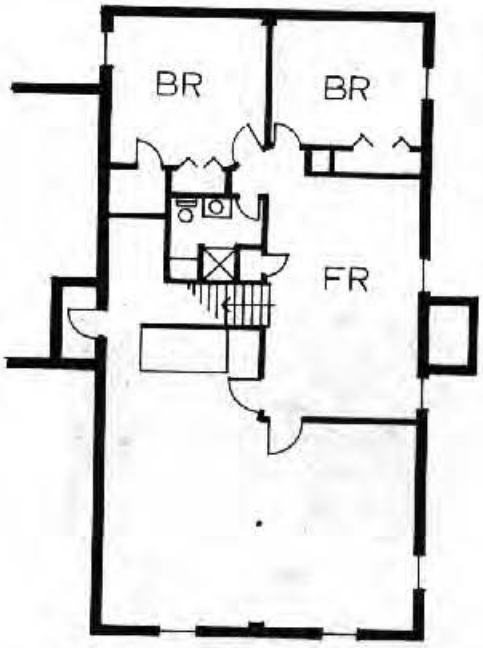


The active solar system in the Colgan ranch style house (opposite right) -- with 1683 sq ft on the main level -- is an active air flat plate collector with phase change material (PCM) storage. Installed in 1978, the 18 Solar Aire collectors (no longer available from the manufacturer who was in Mead, Nebraska) are arranged vertically along the garage wall. Each double glazed panel measures 3'x6', so the total collection area is greater than 300 sq ft. Sun heated air is moved to storage by an 850 cubic feet per minute (cfm) squirrel cage fan.

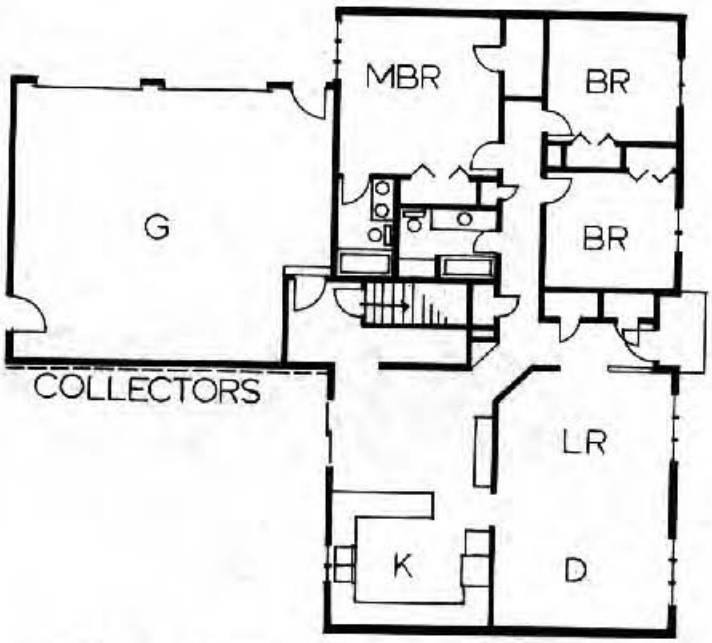
The storage (opposite left) consists of 65 plastic rods -- each 6' long and 3.5" in diameter -- containing calcium chloride hexahydrate from Dow Chemical. The original storage system -- salt storage trays from Solar Inc. of Mead -- leaked and was replaced by the plastic rods despite the fact that the rods do not transfer heat as readily.

According to the owner's calculations, between 250,000 to 270,000 Btus are collected daily during the winter -- enough to provide between 50% and 60% of the building heating load despite indications that there are air leakage losses. During the coldest weather a natural gas backup unit is used to supplement the solar system, and, in January, the backup unit runs daily.

The owner would make certain changes were he to start over. First, ductwork would have straight runs, and any joints would be taped tightly. Second, the commercial air handling unit would be replaced by a smaller system of separate components. Third, modern motorized dampers would be used in the air handling unit to reduce air leaks. Despite all the desired changes in the system, the TIF for the Colgan house is 1.6.



LOWER LEVEL



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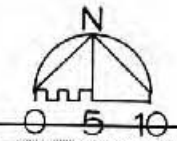
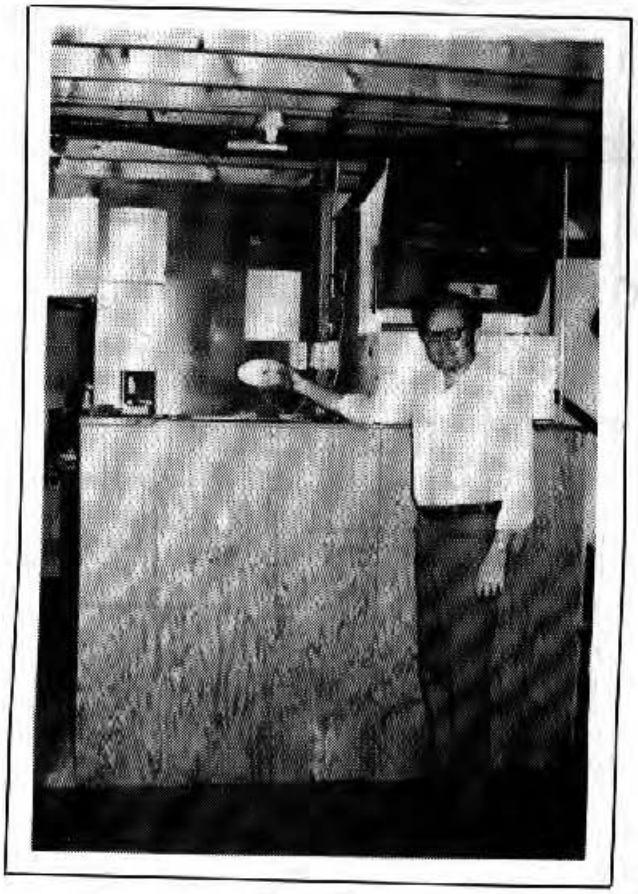
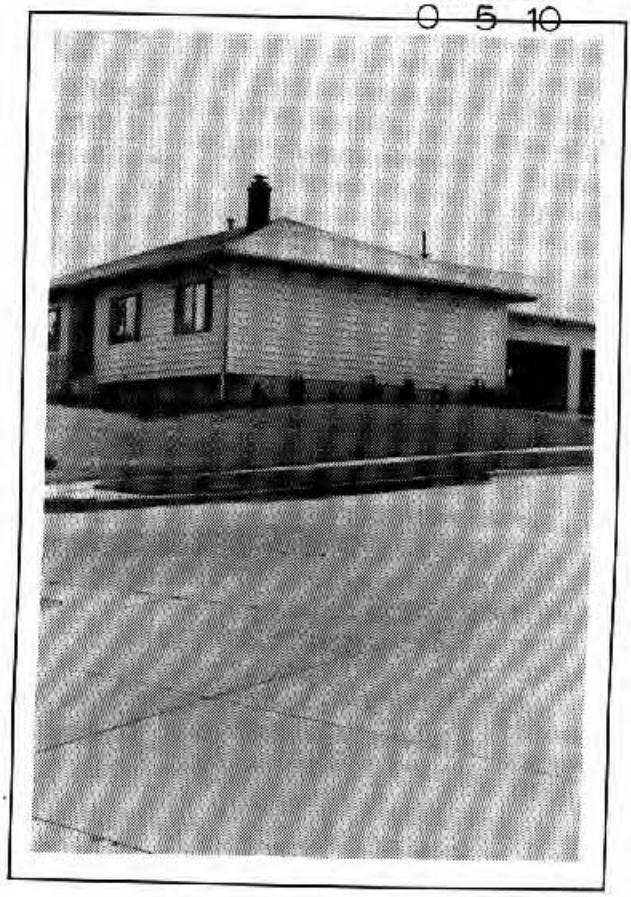




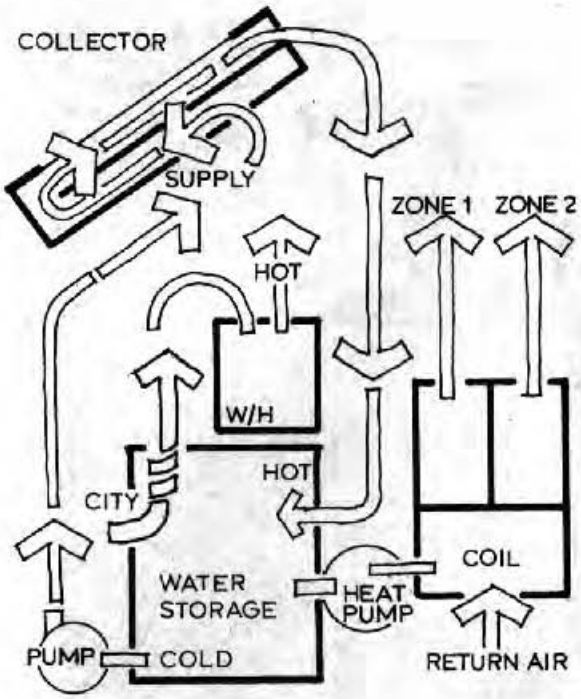


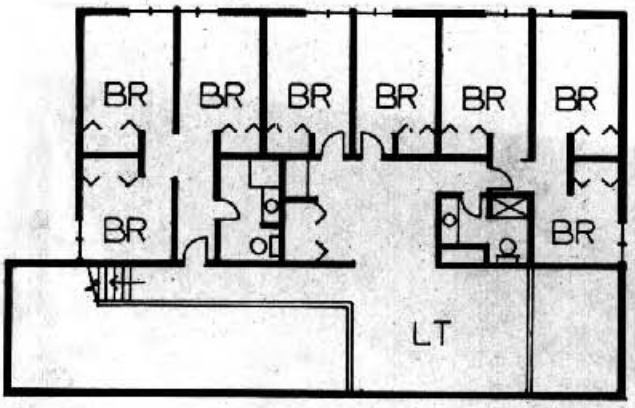
D. DAY

LINCOLN

ACTIVE AIR/HEAT PUMP

The 4000 sq ft Dick Day residence is one of the pioneering efforts in active solar space heating in the state of Nebraska. The flat plate collector system with water storage was engineered by Dick Bourne, formerly of Lincoln, now of Davis, California. In the solar assisted heat pump system (near right) water heated in the collectors is stored in a primary storage tank. A water to air source heat pump draws heat from the hot storage water via a fancoil unit, and this heated air is distributed through a conventional ducting system for space heating purposes. The house is so large that two York water source heat pumps are used in the system. The storage tank also serves to preheat water for domestic purposes, and, during the summer, provides hot water to heat a 30,000 gallon swimming pool.





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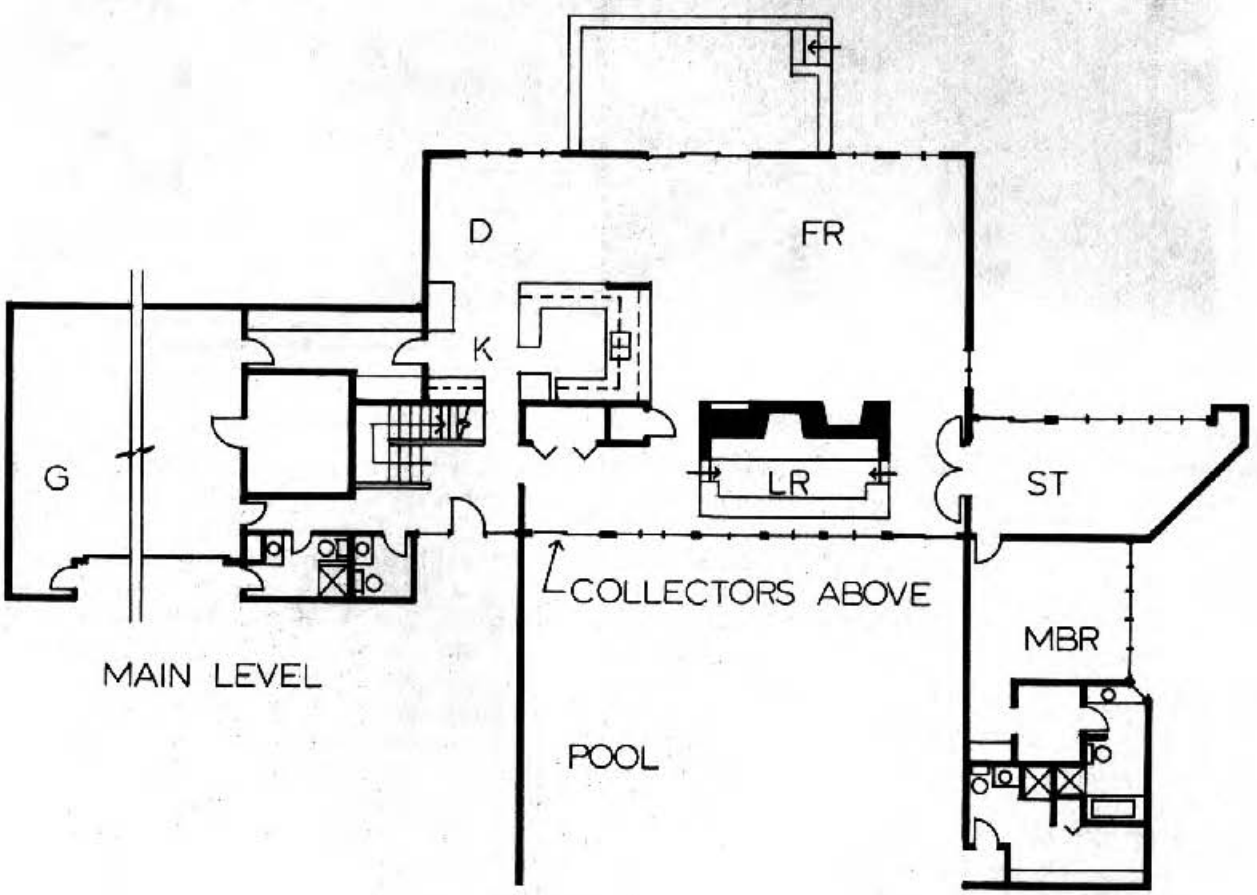

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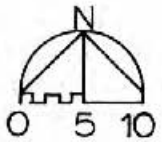


COLUMBUS

JOHANSEN

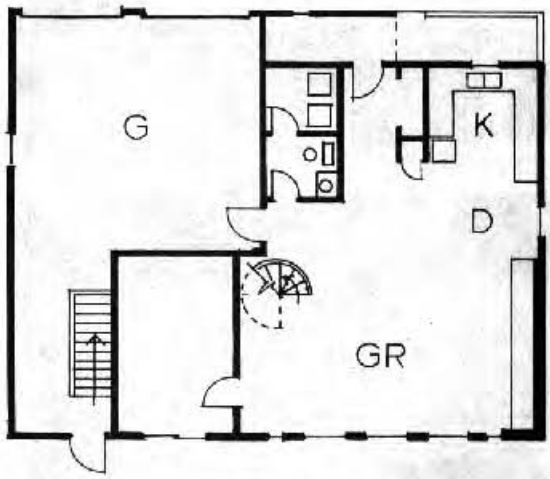
ACTIVE LIQUID-DIRECT GAIN

The Johansen solar home is the home of a builder who specializes in the construction of solar houses. His house, a 2100 sq ft structure with a basement that is used as a preschool, has an insulation level of R-24 in the walls and R-27 in the ceiling. The primary heat supply system used in the house is an active liquid system with water storage, although passive direct gain strategies are also incorporated.

Approximately 260 sq ft of SOLAROLL -- a material the builder now feels is not thick enough for the purpose it serves -- was used as the absorber in the site built liquid collector (opposite right) which is located over the kitchen. The collector is covered with Filon glazing, and two 250 gallon insulated tanks are used for storage. Hot water from the tank storage is circulated to a "Chill Chaser" -- which acts like an add-on radiator -- to warm the room used as the preschool.

A Greenbriar woodburning stove located in the spacious great room is also used to supply heat. The water line to the Chill Chaser runs through the woodburning stove to be heated by exhausting heat. As a result the stove also burns cooler. Backup heating is supplied by electric resistance heating.

120 sq ft of south glazing provides direct gain passive solar heat to the great room where an interior brick wall -- which also absorbs heat from the woodburning stove -- and tile on the floor are used as mass storage. Solar heated air is also circulated to the bedrooms because the great room is open to the upper level (opposite left). The direct gain windows are insulated at night with Window Quilt night shutters.



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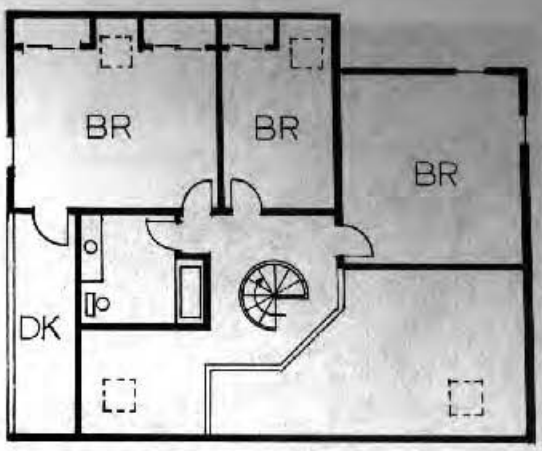

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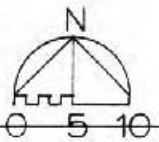
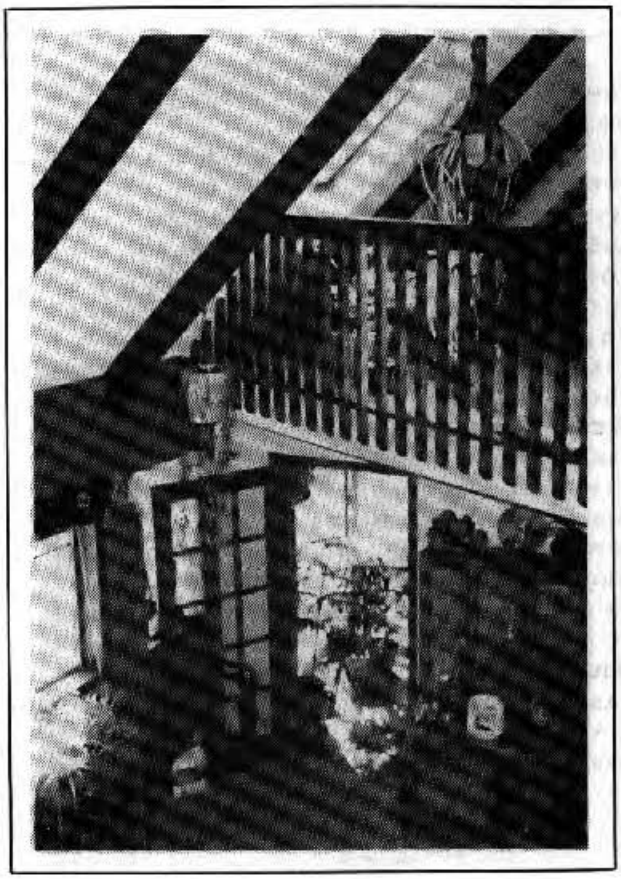
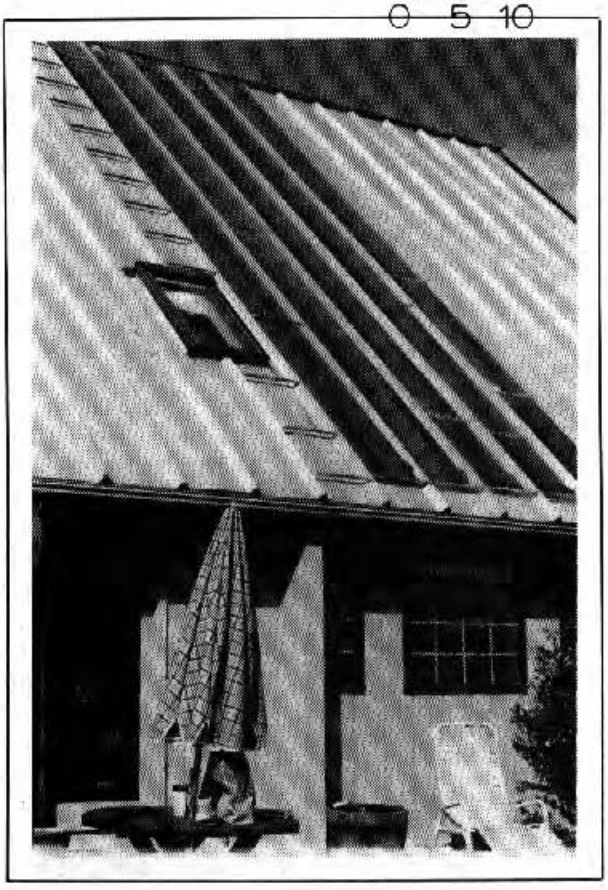
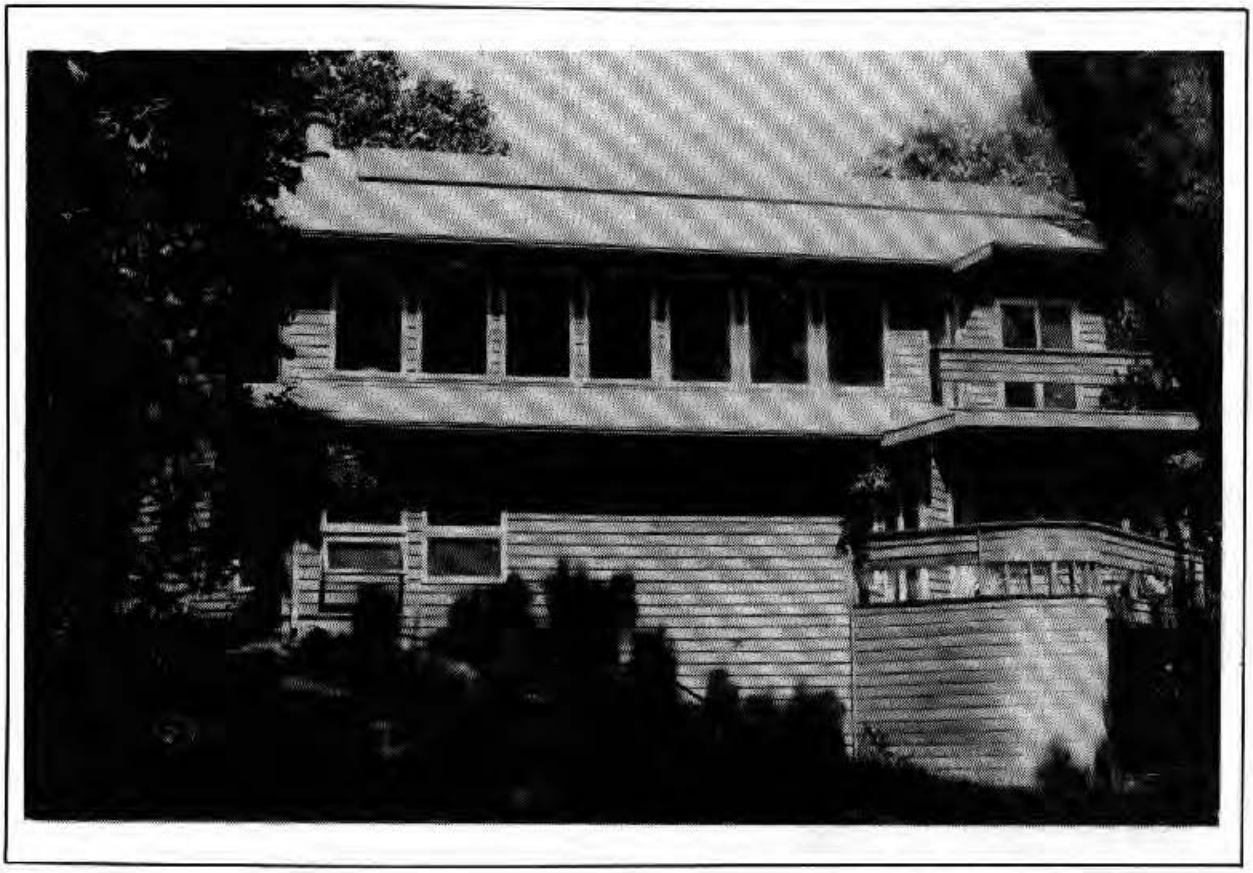




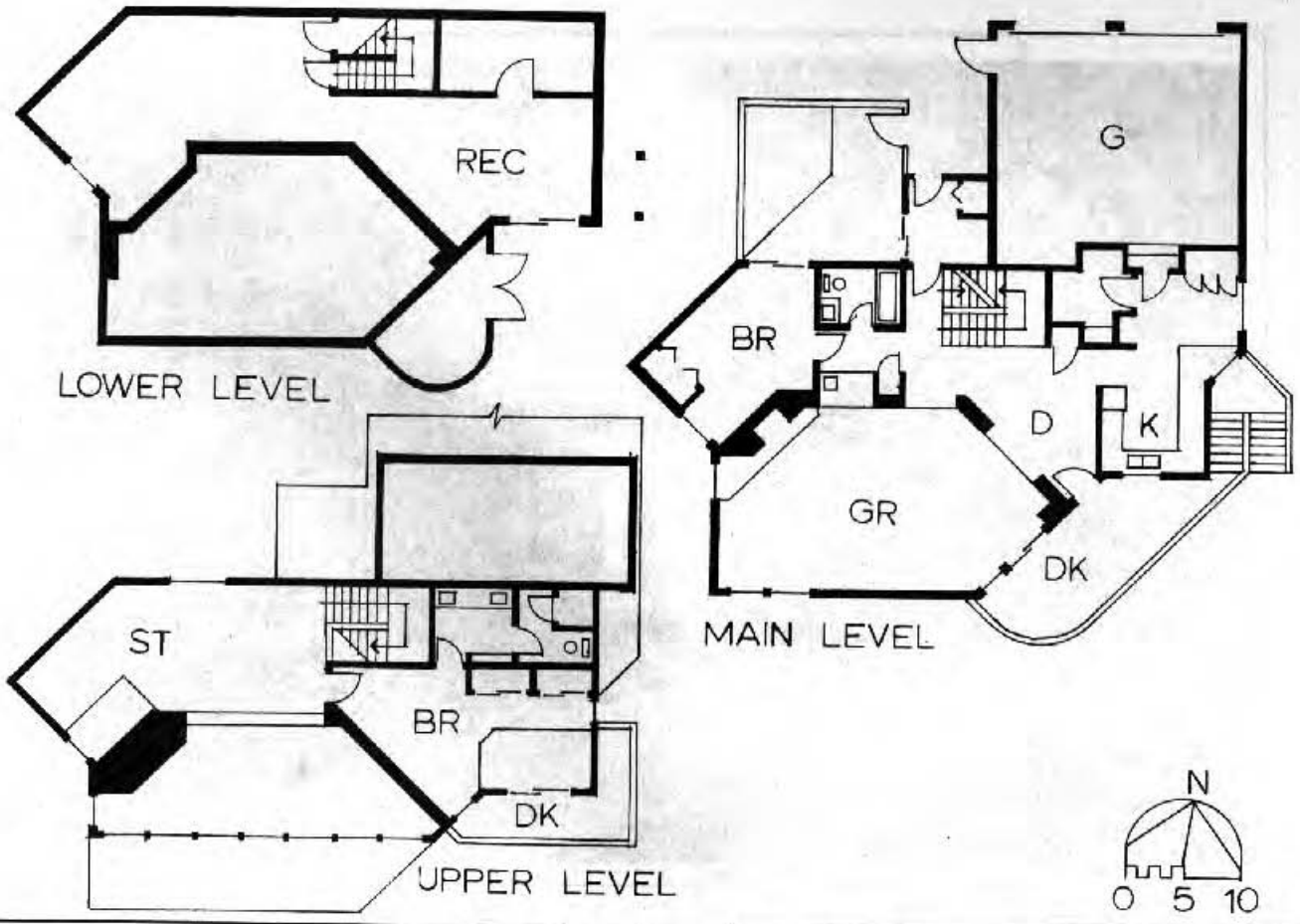




The three-story McGowan home, designed by Ionic Solar formerly of Omaha, is heated primarily by a liquid active solar system with water storage. The contemporary (opposite left) 2300 sq ft house also has 300 sq ft of vertical south facing glazing for direct solar gain.

The active solar system is used to preheat water for domestic use and for storage for a heat pump which is used as a backup space heating system. Ten active liquid collector panels, mounted on the roof, circulate propylene glycol to a 500 gallon tank which acts as mass storage. The owner estimates that at least 50% of the space heating needs are supplied by the active system. Unfortunately, the heat pump system has not been without problems including pump burnout as a result of poor water quality at the site, according to the architect.

The house has some mass storage in the masonry fireplace wall (opposite right) for the direct gain system. The home, however, does not quite face true south and, therefore, loses some potential gain. Solar heated air, collected at the ceiling, is fan forced to a rockbed located beneath the great room. Because of unsatisfactory thermal performance, the owner feels he has had to accomodate his lifestyle to the house. The windows are collecting dust on the inside of the panes, and there have been fogging problems as well. In the winter, the high windows in the great room have caused a cascade of cold air to fall in a column near the windows at night, and the furniture had to be moved away from the windows. As a result, the great room is not used in the winter. Instead, time is spent upstairs in the study. The reverse holds true in the summer when the study area becomes too warm.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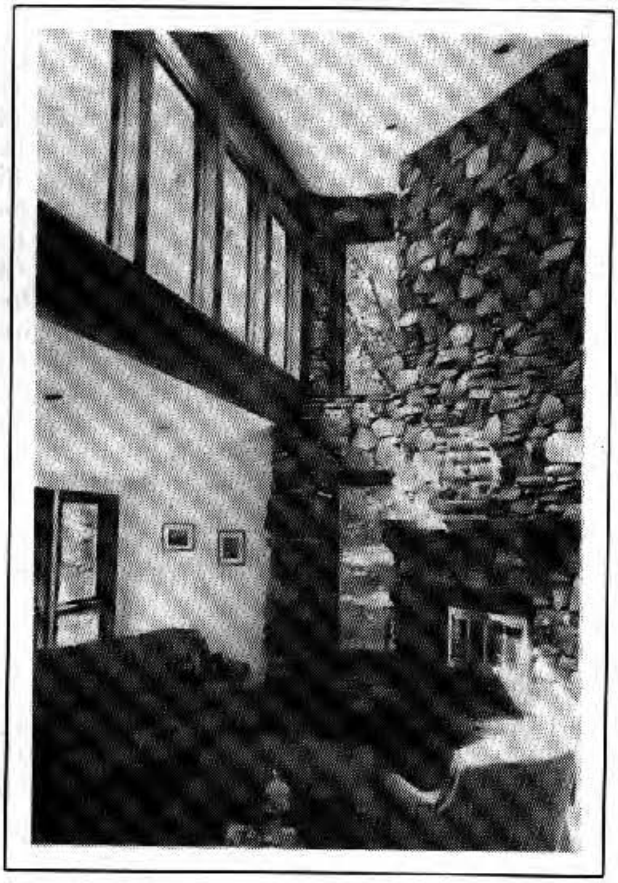
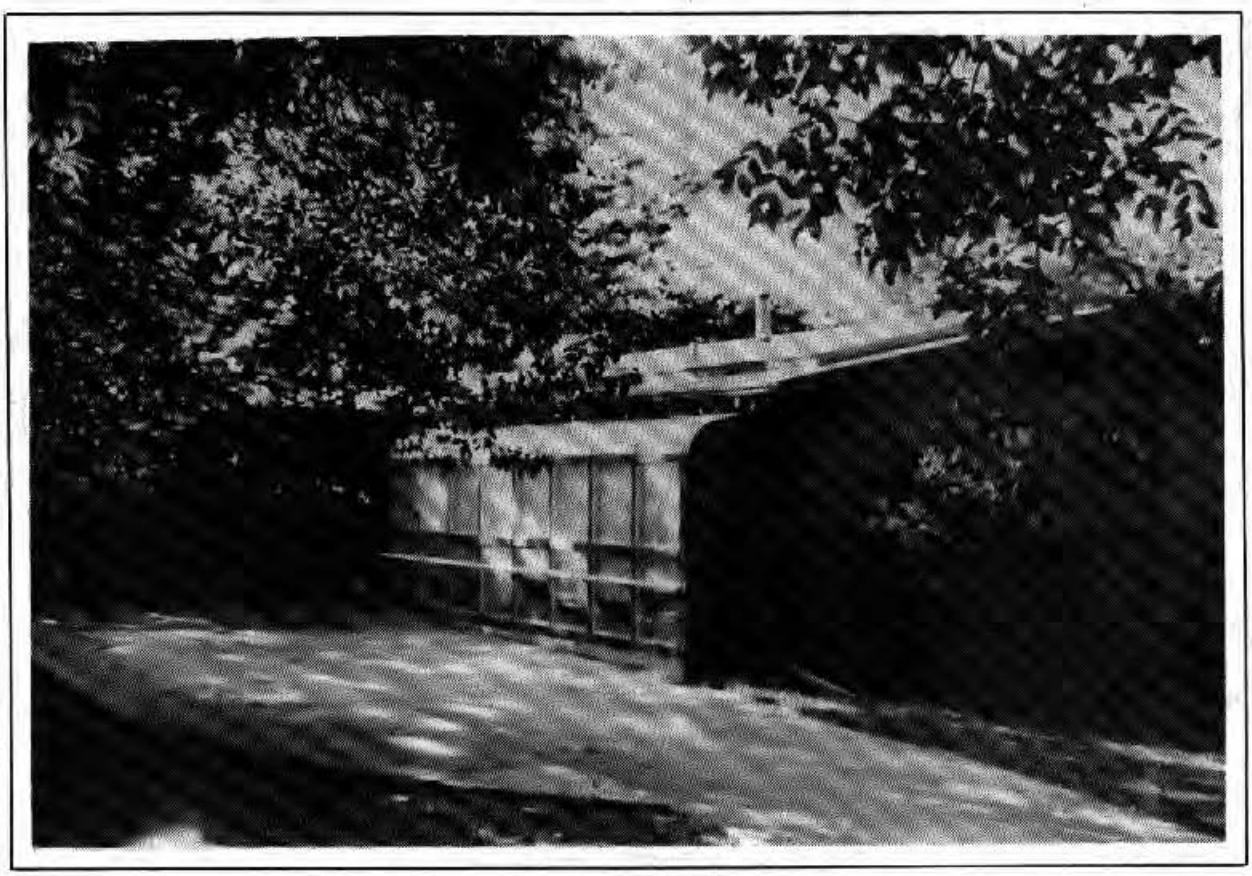


SPURLOCK

LINCOLN

ACTIVE AIR-GREENHOUSE

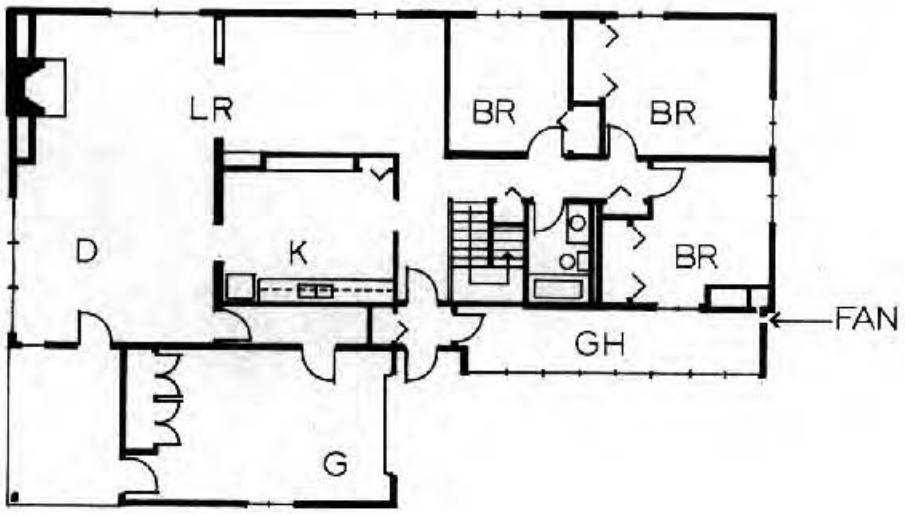


An active air solar collector system with water storage was the first of three major energy conservation and solar changes made to the Spurlock home which resulted in a reduction in gas consumption by at least 60%. The changes to the residence -- which, with 3000 sq ft on two floors, is fairly typical of the houses in the neighborhood -- were made by the previous owner, Charlie Thomsen, formerly a senior partner in the architectural and engineering firm the Clark Enersen Partners, and formerly of Lincoln, now of Albuquerque.

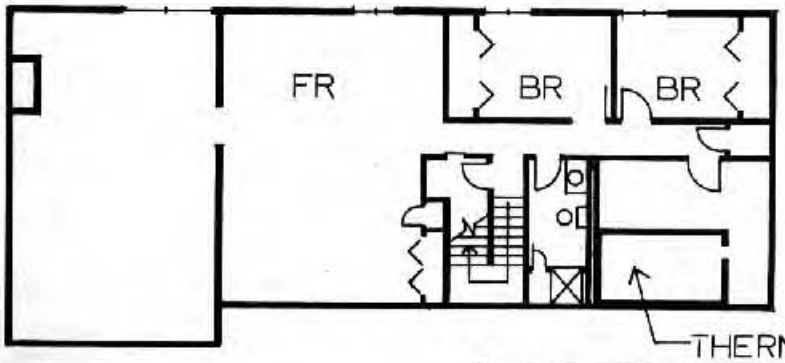
A site built active two pass air collector was added to the roof in 1975. The collector is 56' long and 12' wide with a gross area of 672 sq ft. An inadequate roof tilt angle was remedied by a V-shaped corrugated plate placed between the roof and collectors. A brick storage bin measuring 5'x9'x7' and containing 5 tons of brick is located in the basement, and a water tank used for domestic hot water preheating is buried at the top of the storage bin. The collector fan circulates at 900 cfm and blows sun warmed air to storage (opposite left), and five motorized dampers are used to control a complex array of air flow alternatives. The active system provides 72% of the space heating and 63% of the hot water for the home.

The second change occurred in 1977 when 10" of rock wool insulation was added to the 3.5" of existing batt which had been in place above the ceiling since the house was built.

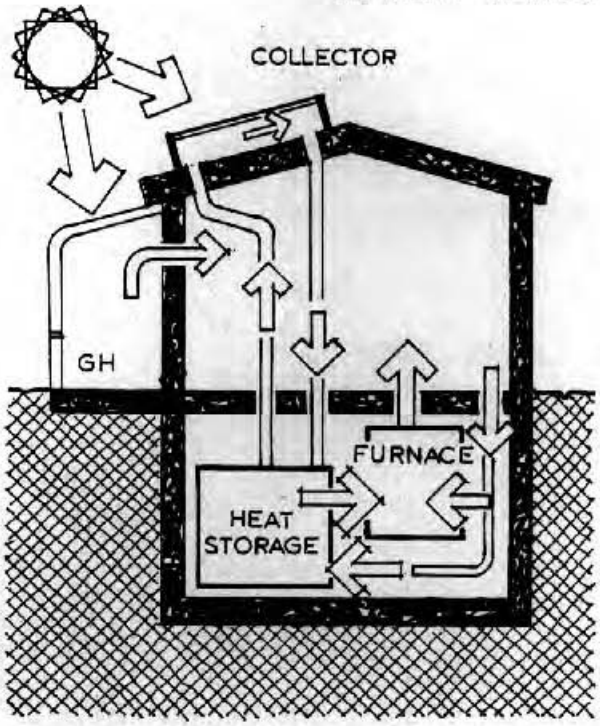
Finally, in 1978, a passive solar greenhouse was added (opposite right). Solar heat is stored in bricks, sand, and water -- the water storage consisting of 5 gallon plastic pickle barrels from a local fast food chain.

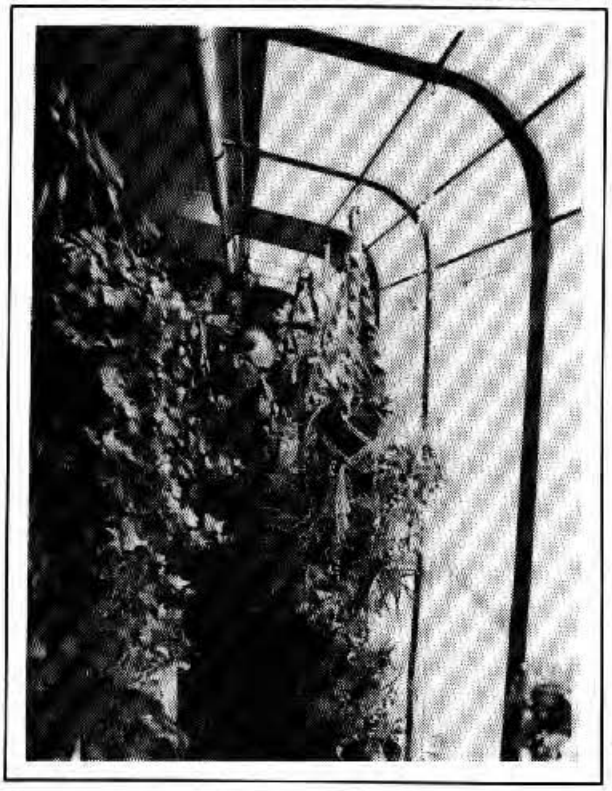


MAIN LEVEL



LOWER LEVEL





ABBREVIATIONS

A	ATRIUM
BR	BEDROOM
D	DINING
DK	DECK
FR	FAMILY ROOM
G	GARAGE
GH	GREENHOUSE
GR	GREAT ROOM
K	KITCHEN
LR	LIVING ROOM
LT	LOFT
MBR	MASTER BEDROOM
N	NORTH
REC	RECREATION
SA	SAUNA
SEW	SEWING ROOM
SOL	SOLARIUM
SP	SCREENED PORCH
ST	STUDY
TW	TROMBE WALL
WS	WORKSHOP

STATE OF NEBRASKA

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