CASE STUDY No. 2

Radiant Heating in a $15,000 Office Building

Example: Greenville Steel and Foundry Company, Inc., Greenville, S. C.

Fabricators of Coils—Greenville Steel & Foundry Company, Inc.

Consulting Engineers—H. G. Faust, Crane Co., Greenville, S. C.—T. Napier Adlam, Chief Engineer, Sarco Company, Inc., New York, N. Y.

Description of Building—Greenville Steel & Foundry Company's office building, situated on U. S. Highway No. 29, north of Greenville, is a two-story, basementless building, measuring 40' x 50'. The land on which it is built slopes away from the highway, so that the first floor is on the ground level, and the second floor is just slightly higher than the highway level.

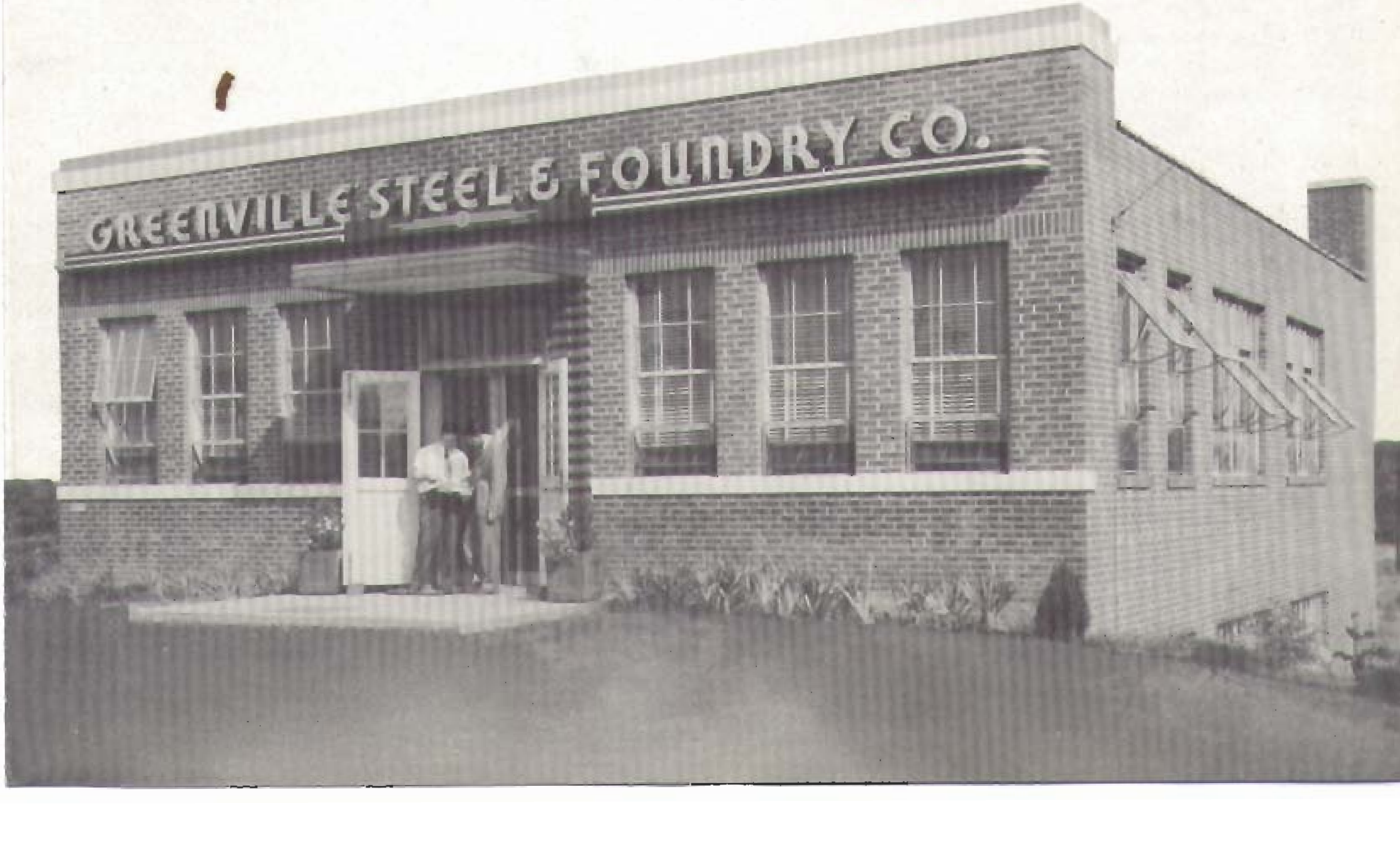
Walls are of solid brick construction, 12" thick, and are painted on the interior side. The single-glazed Fenestra steel sash at the window openings, while very close-fitting, are not weather-stripped.

The ground floor consists of a 2" concrete slab laid on 8" of broken stone fill. The second floor and the roof are 2" concrete slabs poured over Detroit Steel Products Company's Holorib decking, supported by lightweight Bethlehem wide flange sections. Tar and gravel roofing covers the roof slab. To reduce heat loss, the second floor ceiling is insulated with 2" of cork and a slight air space. The under side, painted with aluminum paint, furnishes a reflective surface for the radiant heat from the floor slab.

Drafting and engineering departments occupy the ground floor. The second floor is divided into offices, separated by panels of wood with glass in the upper portion.

Description of the Radiant Heating System—Floor piping for the radiant heating system is ½" and ¾" Byers Black Standard Weight Genuine Wrought Iron Pipe welded into grids with the pipe on 8" centers. Main circulation lines are 1¼", 1½" and 2" pipe. Drop returns from the second floor are ½" and ¾" pipe.

On the ground floor the grid coils were laid on broken stone fill, then covered with more broken stone and a concrete slab. On the second floor the coils were laid on 2" of cork,



and the concrete slab was poured directly on the piping.

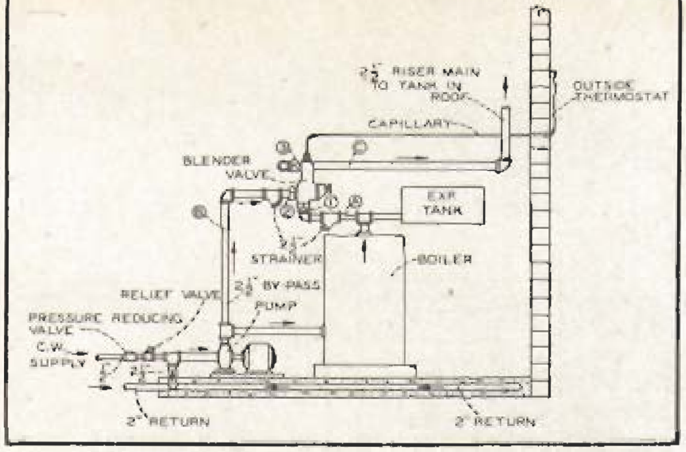
A slight gradient helps to eliminate air in the coils, and provision is made for draining them. Because complete absence of air in the lines is essential to proper performance of the system, a five gallon tank, equipped with an automatic air eliminator, was installed at the highest level, and the water passes through the tank before circulating through the coils.

Grid coils were electrically welded in the shop by Greenville Steel and Foundry Company, who also made the necessary gas-welds in the field when the pipe layout was assembled. Lincoln Fleetweld No. 5 rods were used.

The boiler used is a Crane No. W-16-D oil-fired, 7-tube unit. It is fitted with a nozzle suitable for burning 1.75 gallons of No. 3 oil per hour so that the maximum output of the boiler would be about 175,000 BTU per hour. With a 2.65 gallon per hour nozzle, this same unit would be rated at 279,000 BTU per hour. A Field type M Barometric Draft Control is used. Boiler water is heated to 180°F. and mixed with return water by a Sarco No. 3 water blender so that it circulates through the system at a maximum temperature of 130°F. A 3" Crane, low head circulator pump driven by a 1/3 h.p. Westinghouse Electric Motor maintains continuous circulation through the coils whenever the outside temperature falls below 67°.

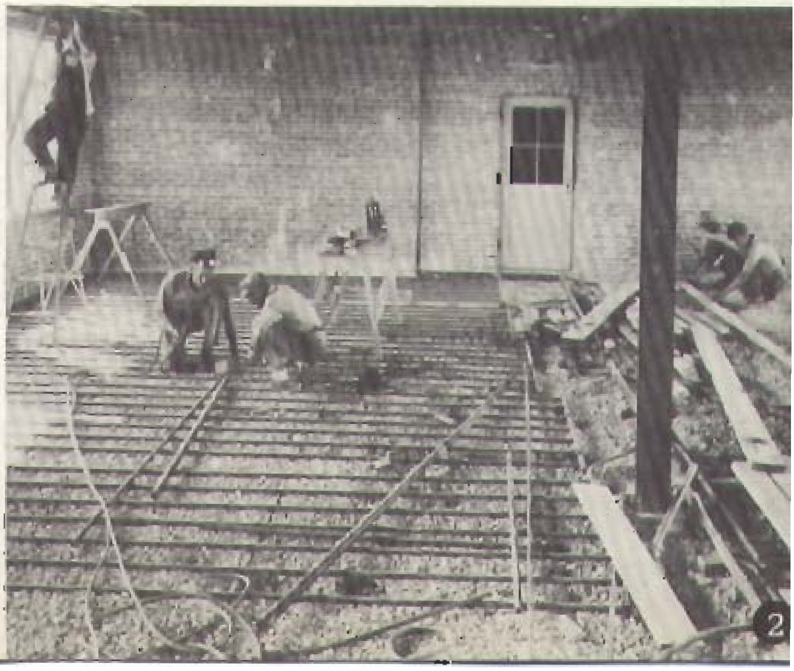
All materials used in the heating system were furnished by Crane Co. of Greenville, S. C.

Temperature Controls for the Radiant Heating System—A thermostatic bulb in the blender valve is connected with a Sarco thermostat, sensitive to both air temperature and local low temperature radiation, which is



placed outside the building but shielded from direct sun rays. If the combined effect of outside temperature and low temperature radiation increases in intensity, the outside thermostat automatically moves the valve to simultaneously check the flow of water from the boiler and increase the flow of the cooler return water from the pump, reducing the temperature of blended water flowing to the system. When the outside air temperature is reduced, or radiation from the sun is diminished, the thermostatic bulb allows the valve to increase the flow of hot water from the boiler and reduce the flow of water direct from the pump.

Performance of the Radiant Heating System—"Frankly, all of us believe that this is the most comfortable building that we have ever worked in and you really cannot tell what the weather is outside after you stay in this building an hour or two . . ." stated Dan H. Wallace, Jr., general manager of Greenville Steel and Foundry Company, on February 14, 1941, during the first winter of the system's operation. On March 1, he wrote us that "you just cannot appreciate this type of heat until you have worked in a building heated with it. Undoubtedly this will mark one of the most notable advances in the science of heating. The old



method of heating the air in a room was just the path of least resistance. . . ."

Employees noticed a marked decrease in colds and winter ills. One woman, who had been experiencing sinus trouble, remarked that she had not been bothered by it since she started to work in the new building. Two men who had been affected by muscular pains gave radiant heating credit for the fact that abrupt temperature changes no longer bring on the pains.

Efficiency was increased. All employees noticed the absence of excessive heat at head level on cold days.

A surprising, but entirely logical effect noted by employees was that clothing wrinkled less and held creases better. They assume that one of the principal reasons is that, because of the even temperature, there are never any periods when they perspire excessively. Clothing was also reported to stay cleaner, reducing cleaning costs.

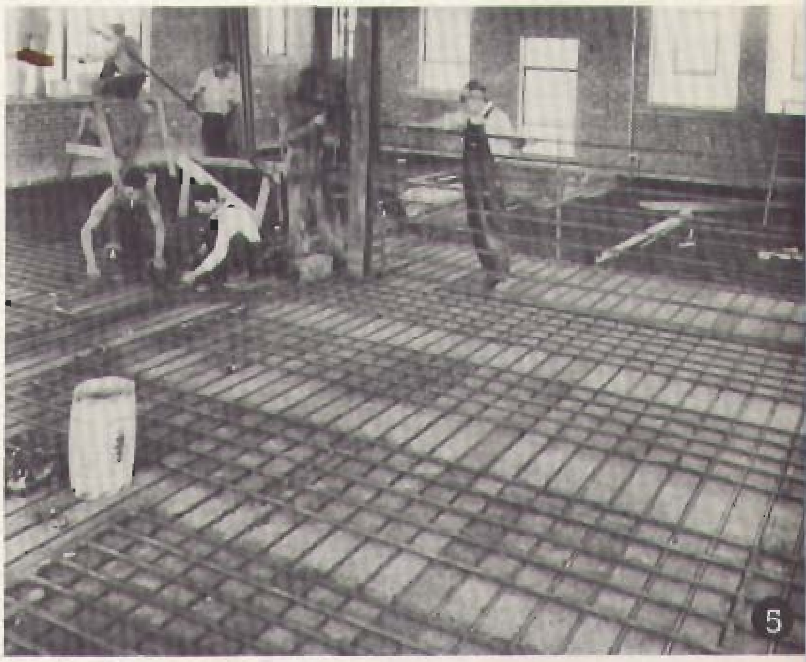
Although the Greenville region seldom has severely cold weather, temperatures as low as seven and eight degrees above zero have been recorded during the past two years.

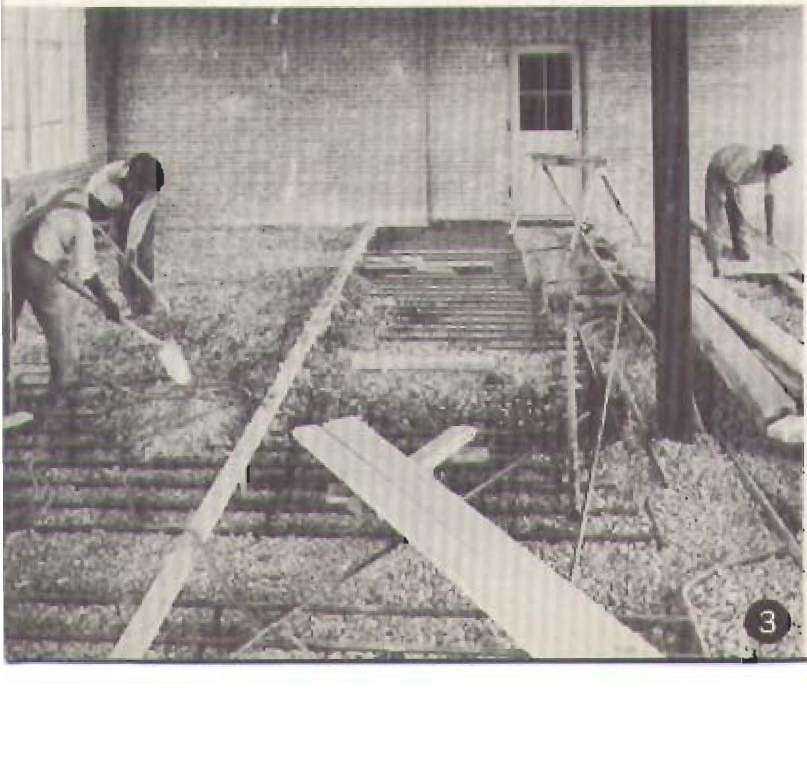
Cost of Installation—The owners of the building state that the cost of installing a radiant heating system, as demonstrated by their own experience, is much more reasonable than the cost of installing a good quality conventional type heating system. While most of the work was done by their own labor, and overhead is merely estimated, the costs furnished by the owners may serve as a basis for arriving at the approximate total cost of an installation for a building with roughly 4,000 square feet of floor space.

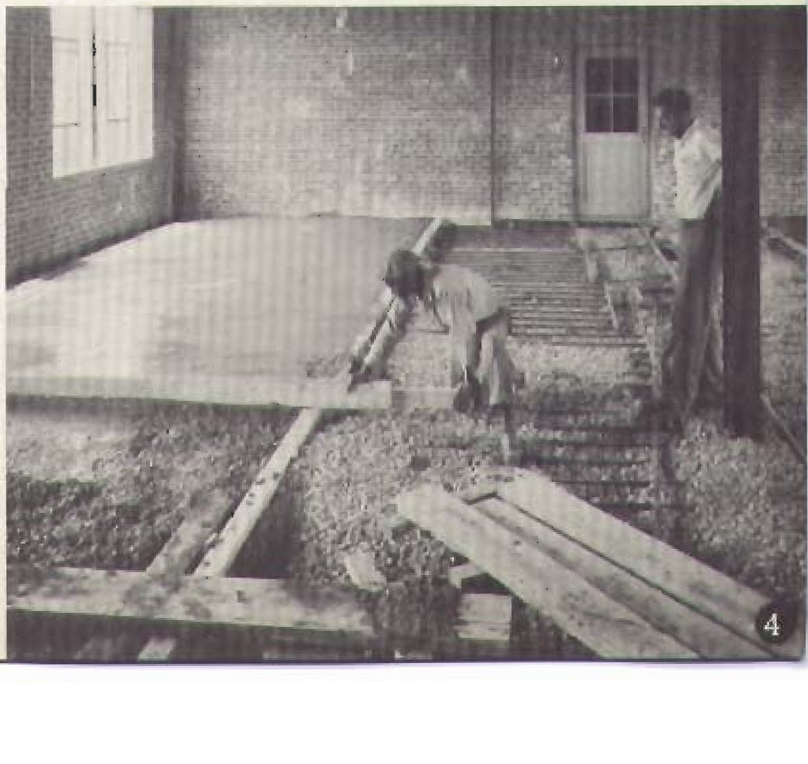
ACTUAL COSTS

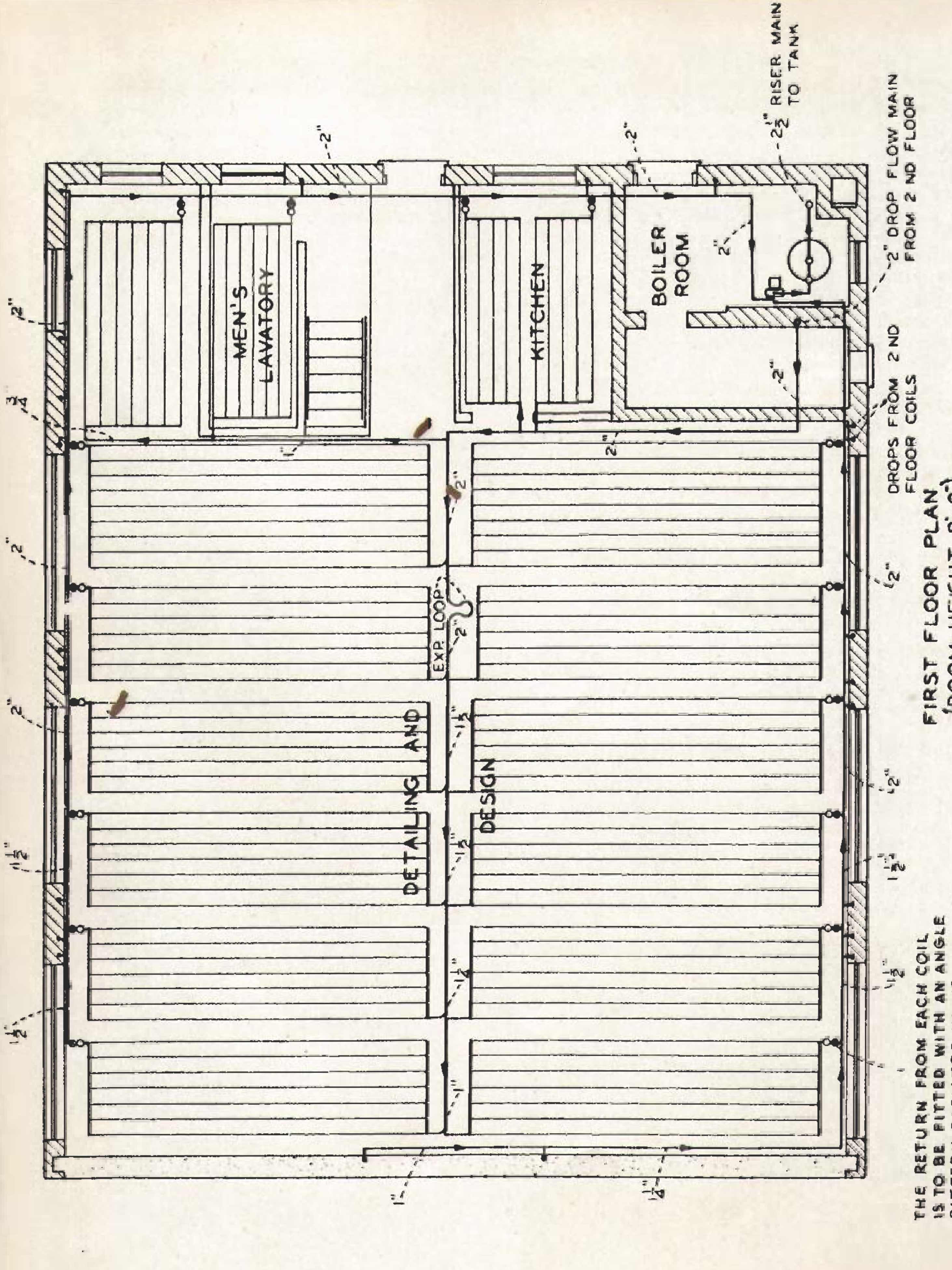
Genuine Wrought Iron Pipe, with Sarcoflow Balancing Fittings	$ 864.50
Labor in shop, fabricating coils	138.43
Field labor, welding	90.30
Boiler and controls	600.00
	$1693.23
ESTIMATED OVERHEAD, at 10%	169.32
TOTAL COST OF INSTALLATION	$1862.55

1. Broken stone fill being placed and leveled on the ground floor.
2. Byers Wrought Iron ¾" and ½" pipe, welded into grids, being placed on the broken stone.
3. More broken stone being placed over the grid coils after they have been properly sloped.
4. Concrete floor slab being laid.
5. Assembling the second floor layout, which is laid on cork insulation.

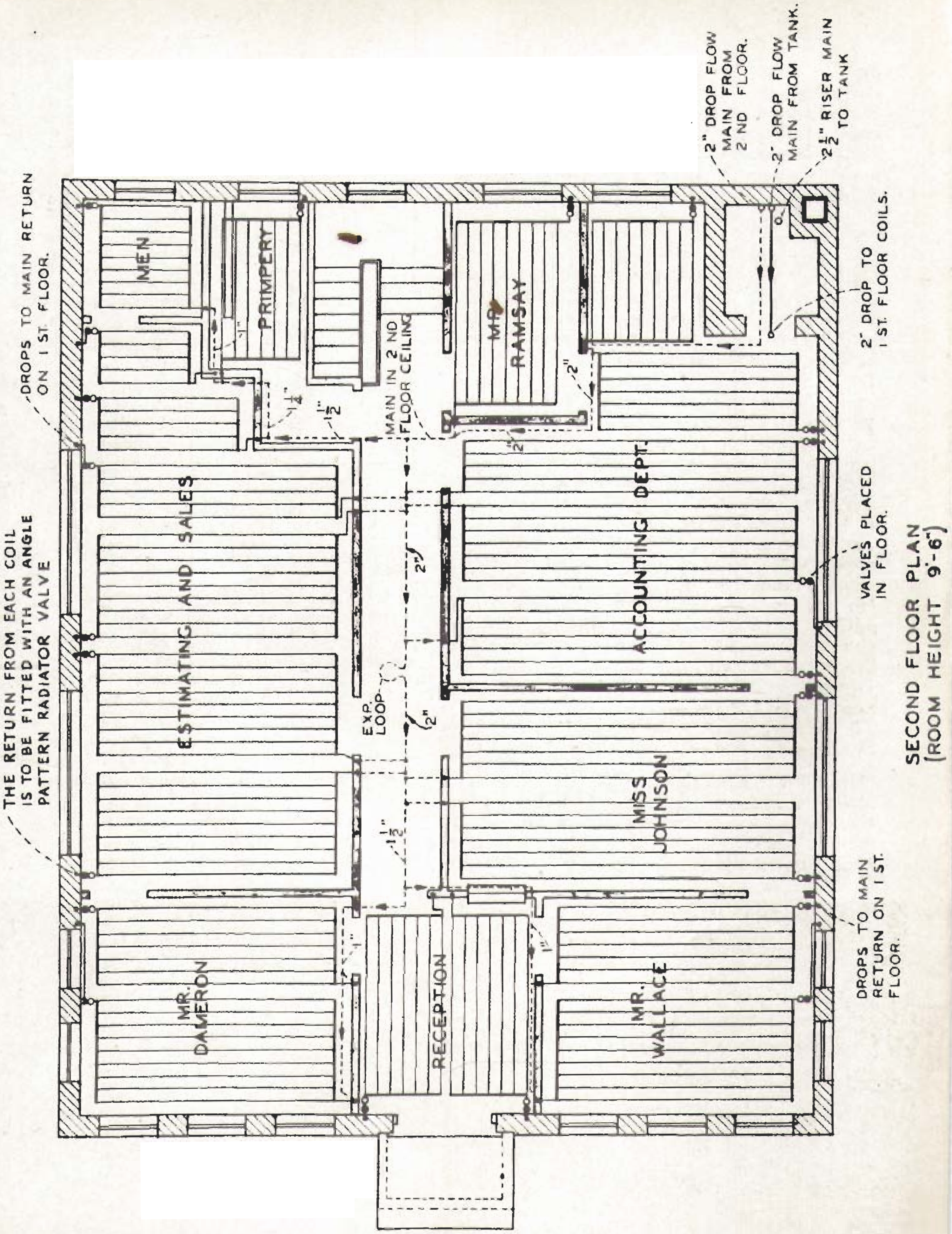








Coil Layout—First Floor



Coil Layout—Second Floor

Cost of Operation—Operating on No. 1 fuel oil, at 6c per gallon, the radiant heating plant in this building consumed 2100 gallons of fuel during the first winter it was in operation, making the total fuel cost for the winter $126. A local engineer estimated that a conventional system to heat the building would require 6000 gallons of fuel for a full season.

Why Radiant Heating was chosen for this building—Much thought was given to the heating system to be installed in this office building, and most of it centered around the comfort of occupants. The owners finally decided that radiant heating could provide the greatest comfort. That the system installed has accomplished this purpose is established by comments of the owners, employees, and visitors to the building.

A contributing reason for installing a radiant heating system was the desire to circulate cold water through the piping to reduce floor temperatures in the summer. However, the rush of business caused by the defense emergency has prevented the working out of all details, and this phase of operating the system has not yet been attempted.

WHAT MAKES WROUGHT IRON IDEAL FOR RADIANT HEATING INSTALLATIONS?

Corrosion Resistance — Because radiant heating coils are inaccessible for repairs, they must be fabricated of corrosion-resistant pipe. The corrosion resistance of genuine wrought iron, in applications similar to radiant heating systems, has been shown by its long service life in hot water piping systems, and in embedded coils in skating rinks. Wrought iron, because of its corrosion resistance, is the most economical protection you can buy against the cost of repairing or replacing coils.

Weldability — Wrought iron's superior weldability is doubly important, for it assures tight, strong seams, free from pin-hole leaks, and it enables sound welds to be made in assembling the coils in the shop and in the field.

Bendability — The soft, ductile nature of wrought iron pipe makes it easy to fabricate into radiant heating coils. It can be bent cold with a minimum of effort and expense.

Heat Transfer — Surface effects, of course, are extremely important in determining rate of heat transfer. The dark, slightly rough surface of black wrought iron pipe encourages heat transfer.

Proper Expansion — Genuine Wrought Iron expands at practically the same rate as concrete. It can, therefore, be embedded in concrete, buried in gravel, or placed between concrete and gravel without ill effects to either the pipe or surrounding materials.

Additional information is available concerning radiant heating installations as well as data on the characteristics and handling of genuine wrought iron. Information can be obtained by writing to the Engineering Service Department.

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