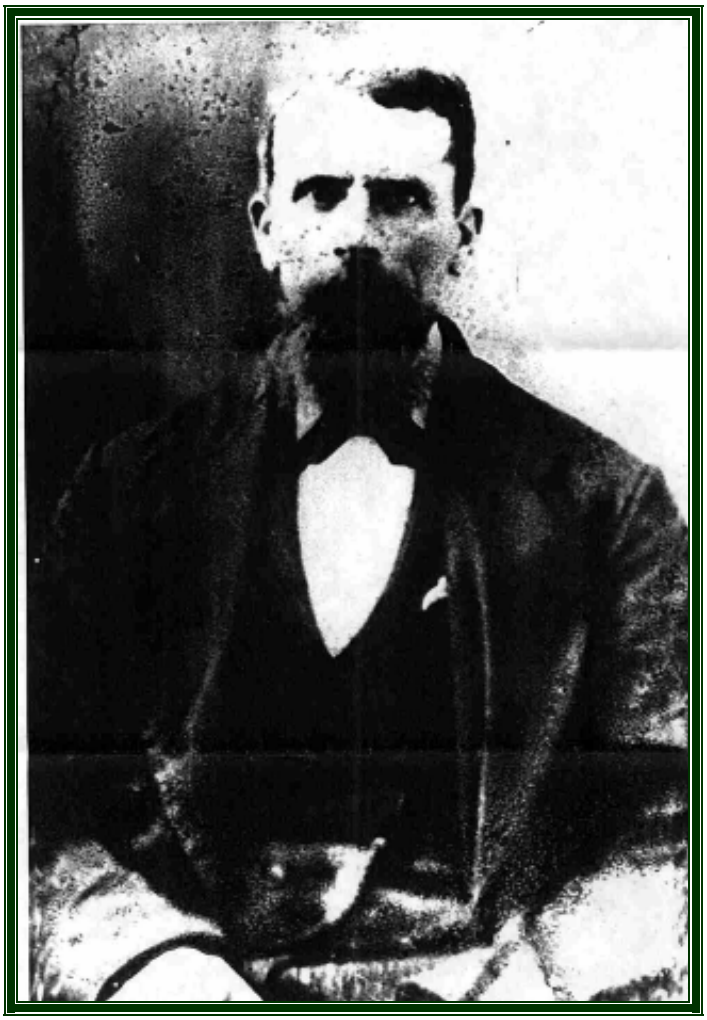
LEWIS W LEEDS
1829-1896



This photograph captioned "Private Leeds" is believed to be of Lewis

[63] Lewis LEEDS **active 1860-1870**

American ventilating engineer. Devoted his attention to the ventilation of government buildings, especially hospitals, during the Civil War. Influenced by the work of Reid [58]. Gave a popular exposition of the principles of warming and ventilation through a series of cartoon illustrations projected by magic lantern onto a screen in a series of lectures at the Franklin Institute, Philadelphia (1866-1867). These were called *Man's Breath is His Greatest Enemy.* "In little domestic scenes on the screen, the audience could observe how the people sat in clouds of purple air that had been vitiated, while robust, pink, fresh warm air clung to the ceiling because of the faulty design of the heating system." Later wrote *Treatise on Ventilation* (New York, 1871). He demonstrated his abilities in a hospital design for the U.S. Surgeon General and Quartermaster General, for which he was awarded a grand prize at the Paris Exhibition. His catchphrase was, "If you would be healthy, always keep your feet warmer than your head, and your back warmer than your face."

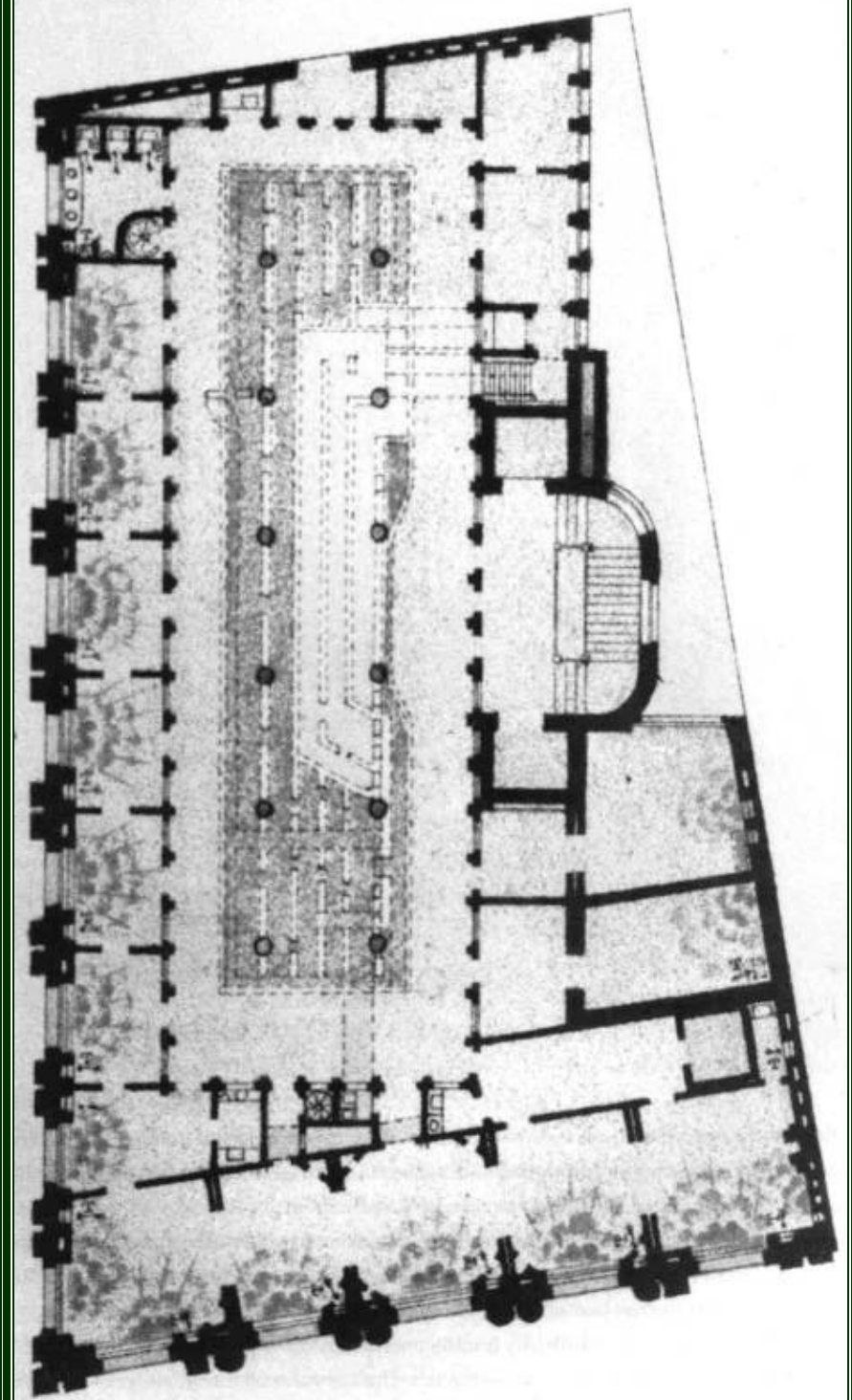
(Mini-biography from "The Comfort Makers," Brian Roberts, ASHRAE, 2000)

The Franklin Institute in Philadelphia

The building also incorporated an innovative system of forced draft ventilation designed by the Philadelphia engineer Lewis W. Leeds. A complex arrangement of flues moved the air by means of heated shafts, as indicated on his plan (Fig. 4.6), rather than by steam-driven fans used in other systems at this time. Leeds received a good deal of publicity for his system; but Post later criticized it, saying that he thought not one of the "entire collection of shafts carried off one cubic foot per hour of foul air."[12]

Description of Leed's Ventilation Scheme for the Equitable Building, New York, 1868-70
Illustrated below

(From "Rise of the New York Skyscraper: 1865-1913,"
Sarah Bradford Landau & Carl W Condit, 1996)



SECOND STORY.

In 1850, the American architect A. J. Downing, in his *Journal of Rural Art and Rural Taste,* deplored the prevalence of what he named "the national poison," which was "nothing less than the vitiated air of *close stoves,* and the unventilated apartments which accompany them."[34] In 1866, Lewis Leeds told an audience in Franklin Institute that although Philadelphia was one of the healthiest cities in the United States, he was "forced to the conclusion that about forty percent of all deaths that are constantly occurring are due to the influence of foul air."[35]

Leeds illustrated his lectures, using a magic lantern to show the way air currents behave with various arrangements of heating apparatus. In the little domestic scenes on the screen, the audience could observe how the people sat in clouds of purple air that had been vitiated while robust, pink, fresh warm air clung to the ceiling because of faulty design of the heating system (Figs. 10.13 through 10.15). The pictures are delightfully amusing, but two aspects of them are worth noting: first, they provide the graphic foundation for the fresh-air fads

that were so numerous and influential in the early twentieth century; second, they are technically quite accurate. Leeds understood very well the mechanisms of heat transfer, recognizing, for example, that the cold walls of a room can make the inhabitants uncomfortable even though the air temperature is at a comfortable level. He was also full of slogans. If you would be healthy, he admonished, "always keep your feet warmer than your head, and your back warmer than your face."[36]

(Text extract and Leed's airflow illustrations from
"An Illustrated Sketch of Central Heating: 1800-1860," Eugene S Ferguson,
From "Building Early America," Charles F Peterson (Ed), 1976)

FIG. 10.

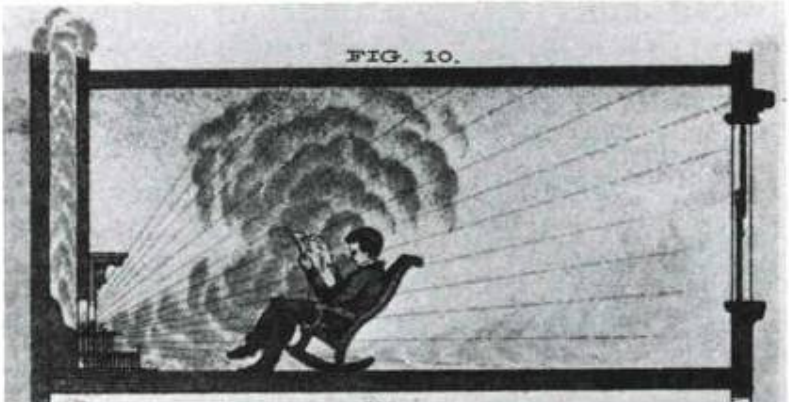


FIG. 11.

FIG. 12.

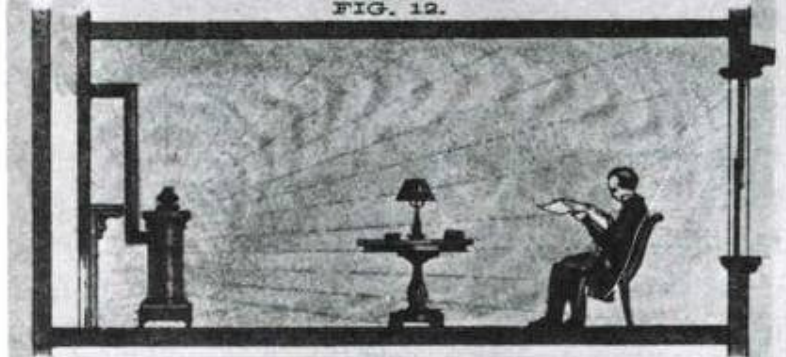


FIG. 13.

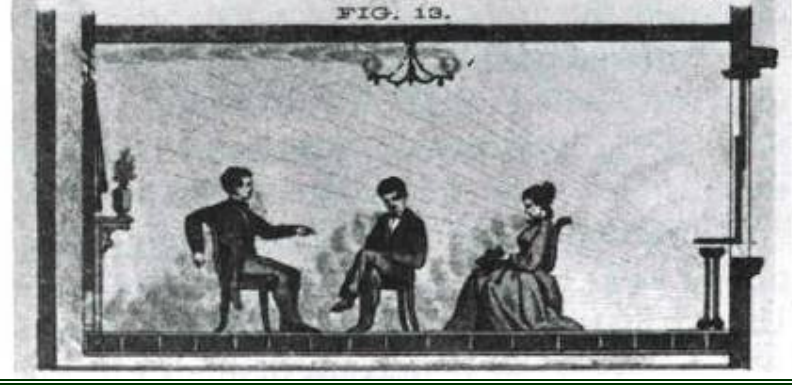


Fig. 10.13 Popular exposition of the principles of warming and ventilating. These illustrations were projected onto a screen by Lewis W. Leeds during his 1866–67 lecture series in the Franklin Institute, Philadelphia. They appear in his *Treatise on Ventilation* (New York, 1871). The clouds represent air exhaled and thus vitiated. The straight lines represent radiated heat. *Fig. 10* shows how feet are chilled by cold current from the closed window while reader breathes warm but vitiated air. *Fig. 11* shows how, with the given heating system, one may "keep the feet warmer than the head, and the back warmer than the face." *Fig. 12* notes the radiation from the man's back to the cold window, chilling his back and legs. The room's air is totally vitiated. *Fig. 13* depicts an optimum condition. Some fresh air is admitted to the room just above the radiator at right. Vitiated air is removed at floor level *(left)* and from the gas lighting fixture near the ceiling.

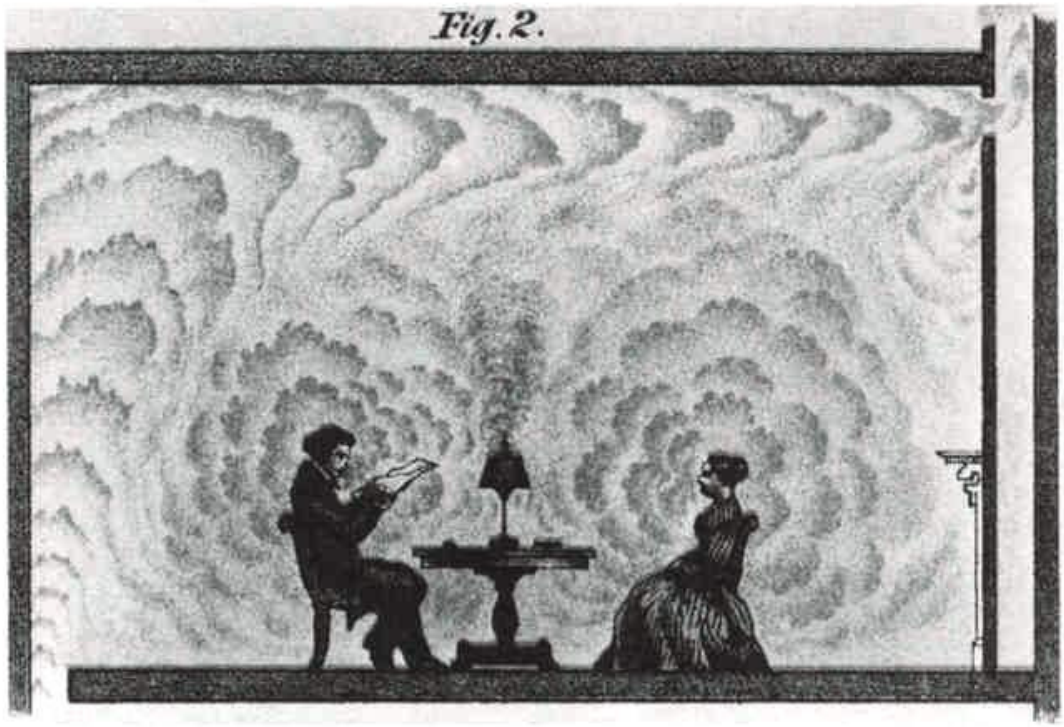


Fig. 10.14 Fresh, heated air, admitted at lower left, rises and flows across ceiling to the exhaust register at upper right. The clouds of heavily vitiated air, purple and unpleasant, which surround the man and woman, are nearly undisturbed by the badly designed heating system. Lewis W. Leeds, *Treatise on Ventilation* (New York, 1871) fig. 2.

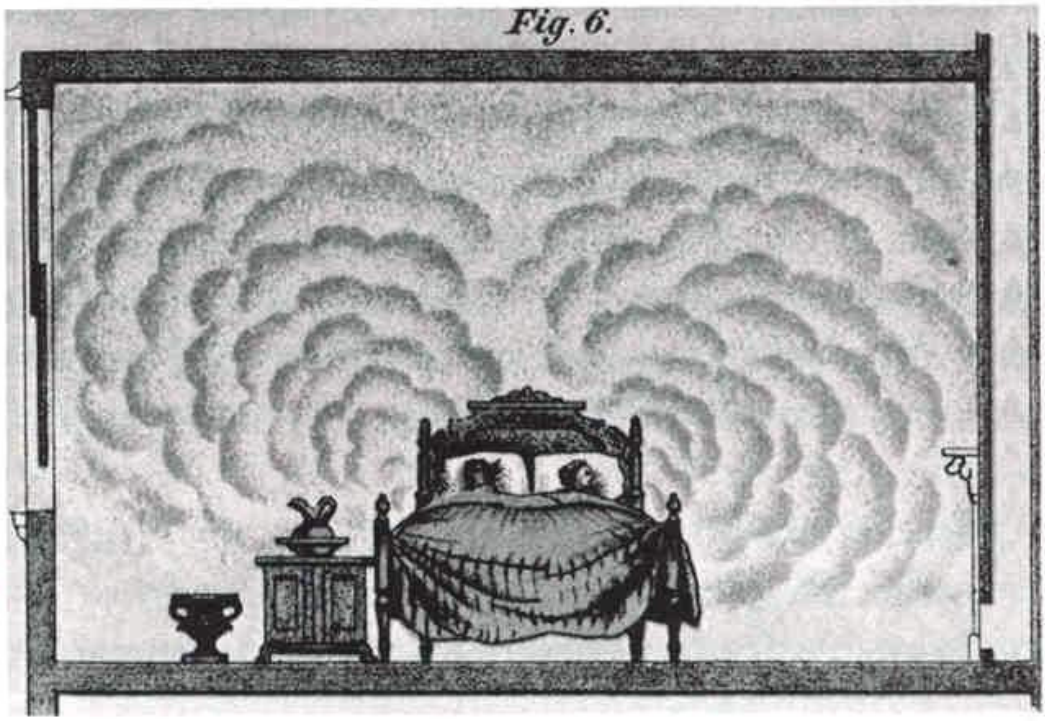


Fig. 10.15 The open window, at left, permits cold air to enter, but the air flows across the floor and up the chimney while the sleeping victims are surrounded by the air that they have vitiated. Lewis W. Leeds, *Treatise on Ventilation* (New York, 1871) fig. 6.

1ST Series.

Mechanics, Physics and Chemistry.

LECTURES ON VENTILATION.

Delivered before the Franklin Institute, by L. W. Leeds, Esq.

LECTURE II.—(Continued from page 328.)

It is in connection with this system of heating by circulating warm air, that the erroneous views in relation to ventilation generally entertained by the public, produce the most injurious effects.

The special points to be borne in mind in considering this subject are that, when in motion, warmer air rises and colder air falls; but when at rest, the stratums of air of different temperatures arrange themselves horizontally.

One other thing: we must remember *temperature* has nothing to do with the purity or impurity of the air. The pure air entering a room is *sometimes* colder than the average temperature of the room, and falls to the floor, forcing the warmer, and, in that case, fouler air to the upper part of the room.

But frequently, in winter, the fresh air enters *warmer* than the average temperature of the room, and *rises to the ceiling*, and flows across the room above the colder and fouler air that has been longer in the room. You must not forget the experiments in our first lecture, showing that the breath in an ordinary room, of a temperature of 70°, fell to the floor instead of rising to the ceiling. I propose illustrating this part of our subject, by using a little glass room to show the movements of air of different temperatures. We can either use air of different temperatures, showing the motion of the various currents by a little smoke; or, as the laws governing the circulation of liquids of different densities are so similar, and by the use of a little coloring matter will express to an audience of this kind more promptly and clearly the ideas which we wish to convey, we therefore propose using the different colored liquids this evening.

The colors, of course, have nothing to do with the densities, but are merely used as a convenient method of designation; the red representing heat or lightness, and blue coldness or density.

The room is now filled with clear water, slightly blue, to represent cold, and a little salt, which makes it a little more dense than fresh water. Now, I will let in a little fresh water, colored red by cochineal,

JAN — JUL 1867

Introduction to one of Leed's "Lectures on Ventilation"
(Copies of Lectures held in the CIBSE Heritage Group Collection)

LECTURES ON VENTILATION:

BEING A COURSE DELIVERED IN THE

FRANKLIN INSTITUTE,

OF PHILADELPHIA,

DURING THE WINTER OF 1866-67.

By LEWIS W. LEEDS,

Special Agent of the Quartermaster-General, for the Ventilation of Government Hospitals during the War; and Consulting Engineer of Ventilation and Heating for the U. S. Treasury Department.

Man's own breath is his greatest enemy.

NEW YORK:
JOHN WILEY & SON, PUBLISHERS,
2 Clinton Hall, Astor Place.
1868.

1868 (Google Books)

PREFACE.

THESE Lectures were not originally written with any view to their publication; but as they were afterwards requested for publication in the Journal of the Franklin Institute, and there attracted very favorable notice, I believed the rapidly increasing interest in the subject of ventilation would enable the publishers to sell a sufficient number to pay the expense of their publication; and, if so, that this very spirit of inquiry which would lead to the perusal of even so small a work, might be one step forward towards that much-needed more general education on this important subject.

It was not my desire to give an elaborate treatise on the subject of ventilation. I believed a few general principles, illustrated in a familiar way, would be much more likely to be read; and, I hoped, would act as seed-grain in commencing the growth of an inquiry which, when once started in the right direction, would soon discover the condition of the air we breathe to be of so much importance that the investigation would be eagerly pursued.

L. W. L.

Fig. 4

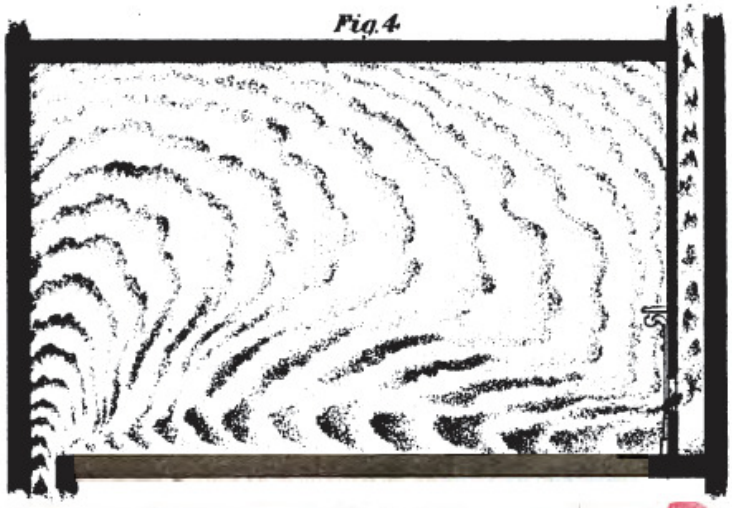


Fig. 5

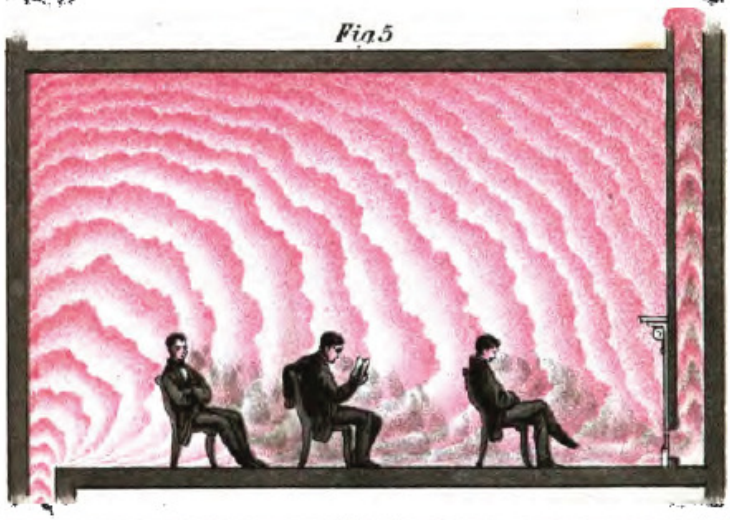


Fig. 6

VENTILATION.

THE GRAND PRIZE AWARDED AT THE PARIS EXHIBITION.

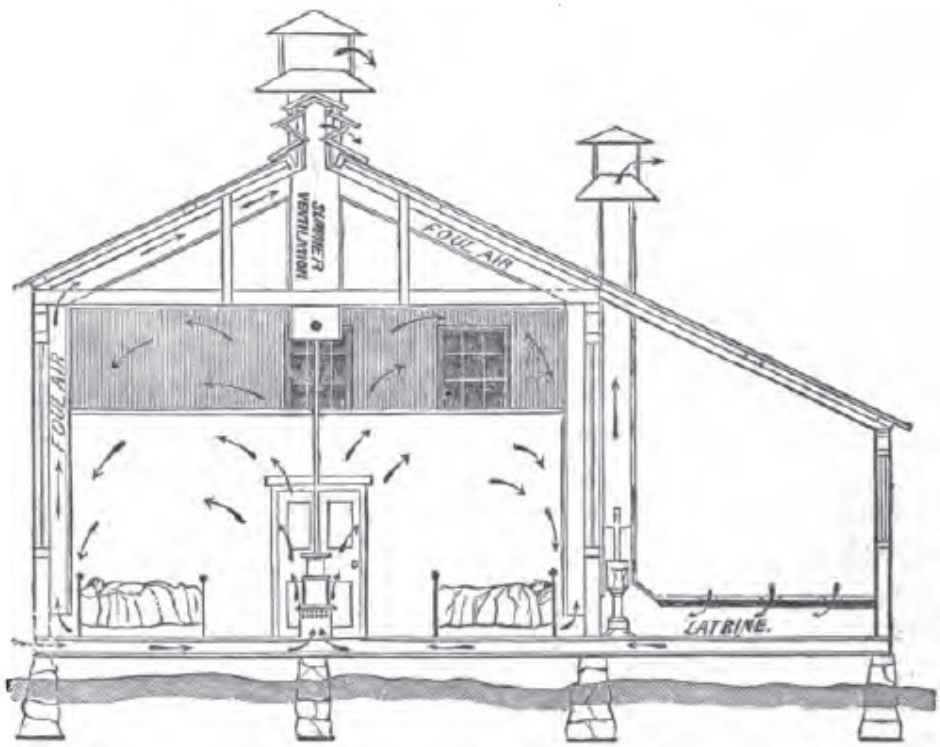
ADDED to the many other gratifying signs of a rapidly increasing interest in the all-important subject of the proper supply of pure air to our houses, is the awarding of the grand prize of the Paris Exhibition to Dr. Evans, for an American sanitary collection.

The Sanitary Commission, during our late war, acted upon the principle since expressed by the report of the Board of Health of New York. They say: "And viewing only the causes of preventable diseases and their fatal results, we unhesitatingly state that the very first sanitary want in New York and Brooklyn is VENTILATION —ventilation supplied in all existing tenant-houses, work-rooms, school-rooms and places of assemblage—and in all that shall hereafter be constructed."

The early recognition during the late war, both by the Sanitary Commission and the government officials, of the important fact that many more men are killed by breathing foul air than are killed by the enemies' bullets, led them to use very active exertions to secure good ventilation in hospitals and camps, and to teach the men themselves the value thereof. The result has been highly satisfactory. The fact that we must make some positive provision for a constant supply of fresh air to every occupied room, and not rely on accidental cracks and openings, is now very generally felt. The simple, practical and efficient means used by the government has done much towards creating this wholesome public opinion.

The annexed plan (excepting a stove and twelve beds, omitted from centre of plan, indicated by the space) is a copy of one I furnished the Committee; and which was faithfully executed in preparing one of the models of hospitals, the arrangements of which have been so highly appreciated, and has shared one of the grand prizes at the Paris Exhibition.

It is a representative plan, showing the general arrangements of wards in a large number of the hospitals.



in the closet were fastened shut, and then the air to supply this large exhaust shaft was drawn from the adjoining ward or room, which ventilated that ward and prevented any unpleasant odor from the closets returning into the ward.

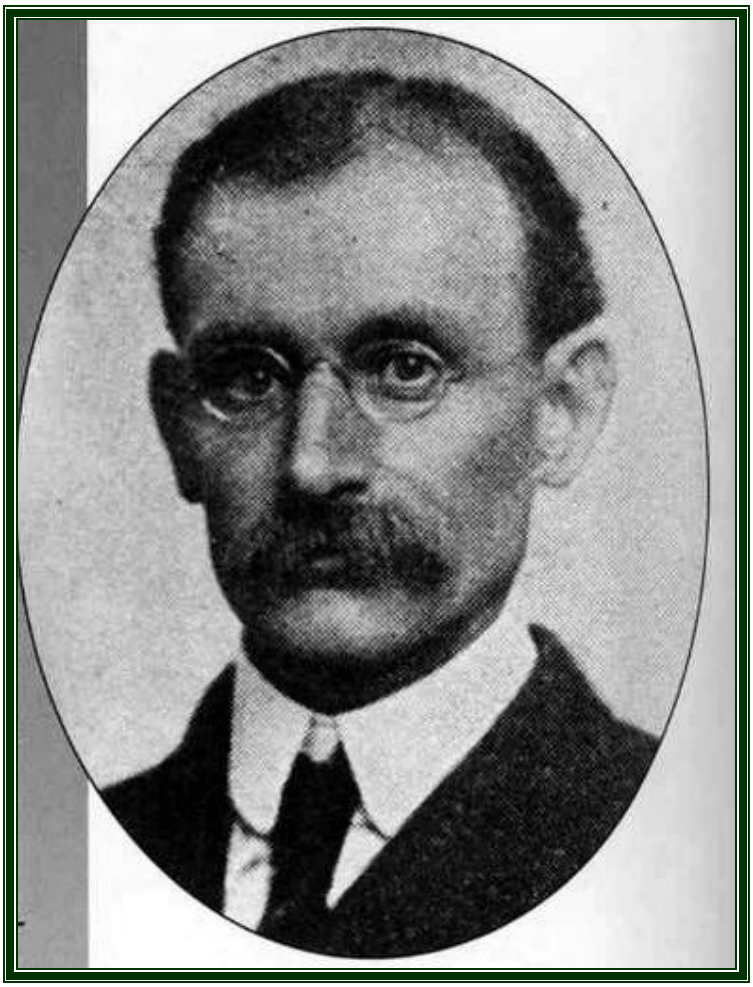
Wherever it was possible, a sheet iron or cast iron pipe was carried up into the centre of this shaft from the kitchen, laundry, bakery or any other constant fire, and where no heat from a permanent fire or from a steam coil could be obtained, a small stove for the purpose was provided.

LEWIS W. LEEDS,
Germantown, Pa.

7th mo. 26th, 1867.

(Extract from Leed's Grand Prize for his Hospital Design, Paris Exhibition)

DAVID (DAVE) LENNOX
1855-1947

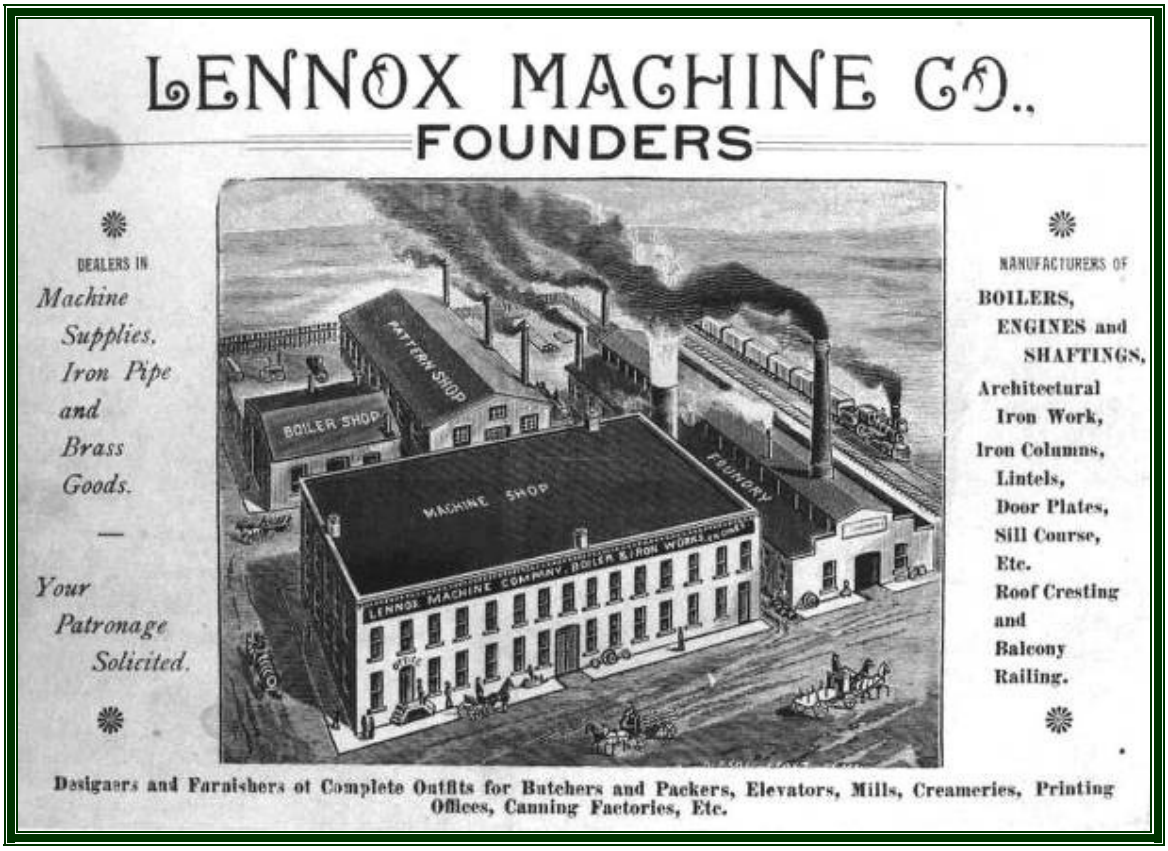


Founder of the Company that became Lennox International

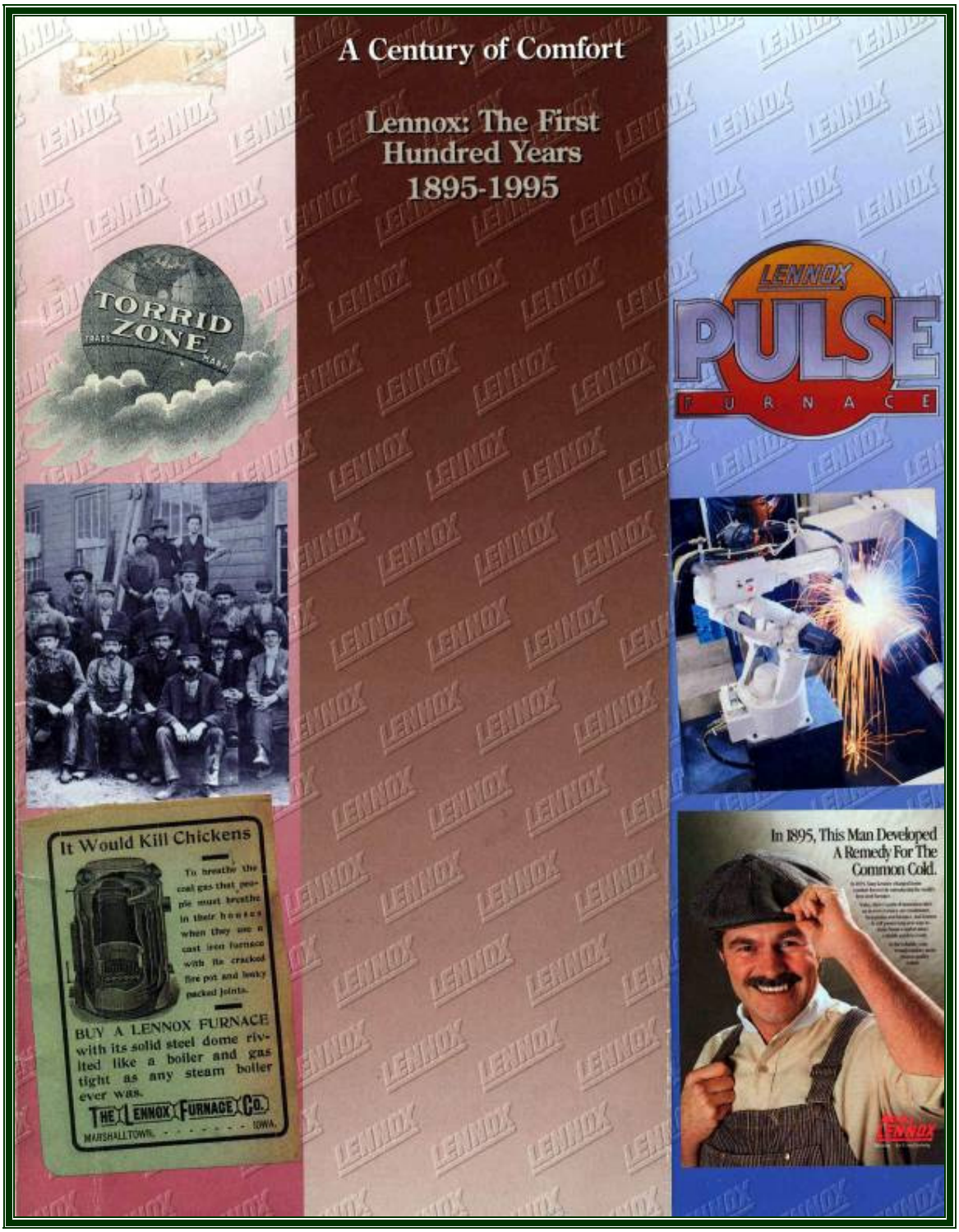
[46] David (Dave) LENNOX **1855-1947**

American engineer. Son of an expert railway mechanic, he "inherited an astonishing mechanical ability from his father." Went to Marshalltown, Iowa (1881). Started a machine shop and then founded Lennox Machine Co., which manufactured architectural materials, boilers, engines, and farm implements. At this time, home furnaces were made of cast iron, which warped and cracked after extended use. Dave Lennox built the first rivetted steel, coal-fired furnace (1895). His superior furnace became popular but Lennox soon tired of the business and sold out to D.W. Norris and other investors (1904); the new company sold 600 furnaces in the first year. The humble machine shop started by Dave Lennox grew into one of the major heating and refrigeration manufacturers in the USA, becoming Lennox Industries (1955) and then Lennox International (1984).

(Mini-biography from "The Comfort Makers," Brian Roberts, ASHRAE, 2000)



The First Factory was established in 1888



Lennox Centenary Brochure (CIBSE Heritage Group Collection)

1. A New Heat Wave: 1895-1926

Carrying only a few personal belongings and a bag of tools, a quiet-looking young man of 26 stepped from a train at the Marshalltown, Iowa railroad station on July 4, 1881. His name was David Lennox, just in from Chicago and looking to start a machine shop. "I walked from the railroad station to the town well," he later recalled, "and water never tasted better."

Lennox was born in Detroit, Michigan on April 15, 1855, the son of an expert railroad mechanic. He inherited an astonishing mechanical ability from his father, and the two must have enjoyed a close relationship when Lennox was very young. Tools and machines were part of Lennox' life from his earliest years. The family moved to Aurora, Illinois shortly before the Civil War.

When the Civil War began, his father signed up for a three-month enlistment. It was widely believed the conflict would be over in 90 days.

But the war dragged on, and Lennox' father re-enlisted for three years. "When my father left home the second time," he said, "I never saw him again."

The Lennox family moved to Chicago, where Lennox' mother ran a grocery store and he worked at various machine shops. As he worked, he continued to develop his almost instinctive knowledge of tools and the ways they could be used.

When Lennox combined this inherited practical knowledge with his own special inventive genius, he must have been excited by the possibilities. It was a boom era for industrial America, when railroads were starting to stretch from coast to coast and scientific pioneers such as Bell, Carver, Edison, Maytag, and Firestone were laying the foundations for the next century. For inventors and manufacturers, it seemed an age of almost daily discovery — an age ideally suited to the talents of David Lennox, who had stepped off the train at Marshalltown with little more than a head full of ideas.

After some tough bargaining with the owner, he found a room in Marshalltown — 20 x 20 feet for $7 a month rent. "For the first few months I didn't make enough to pay the rent," he said. Finally he ran into Ed Sears, a local businessman looking for someone to make staples rapidly and for a good price. Lennox designed a staple-cutting machine which increased production while lowering costs. It was an instant success. Now he could pay his rent and expand his business as well. The reputation of the Lennox Machine Shop started to grow beyond the Marshalltown city limits.

A New Kind of Furnace

One day in 1895, Ernest Bryant and Ezra Smith from nearby Oskaloosa, Iowa dropped by Lennox' shop, eager to show him their plans for a new kind of furnace. The few furnaces used to heat homes at that time were made entirely of cast iron, which warped and cracked after extended use and caused smoke and coal gases to seep into houses. Their design, Bryant and Smith explained to Lennox, was far more durable: riveted steel was used for the heating surface and iron castings for the grates, fronts, and other parts. Could he help them make the iron castings for their furnaces?

Lennox reluctantly agreed. His business was growing and he was planning his own projects, including improving the designs of trowels, heavy-duty shears, and other tools.

"I didn't feel at home making furnaces," he said many years later. But he understood the importance of Bryant's and Smith's ideas. When the two inventors were unable to pay Lennox for the iron castings because they couldn't find financial backers, he took over their patents and started reworking and improving their original design. Sweating for long hours in what one observer described as "sort of an overgrown blacksmith shop," Dave Lennox began building the first Lennox furnaces.

The superiority of Lennox' redesigned furnace was obvious, and Lennox furnaces quickly became popular. But by 1904, Lennox was tired of the furnace business. He was much more excited about his plans to manufacture heavy tools, especially shears. An interested group of local businessmen bought the furnace business from Lennox for $54,789.14 — and during their first year of ownership, the Lennox Furnace Company sold 600 furnaces. One of the primary new owners was David Windsor (D.W.) Norris.

Lennox Furnace Co Employees, c.1905

Assembling "Torrid-Zone" Furnaces during the 1930's

Later enterprises

Following the sale of his furnace business, Dave Lennox continued to manage the Lennox Machine Company in Marshalltown, employing more than 100 people locally in the manufacture of portable gasoline engines, boilermarkers' tools, wagon scales and pressured pipe taps. Lennox sold the Lennox Machine Shop in 1912 to the Ryerson Brothers of Chicago for $110,000, but continued to work in a small machine shop behind his Marshalltown home during his subsequent retirement. Lennox died at his home in Marshalltown on February 15, 1947, at the age of 91

(Wikipedia)