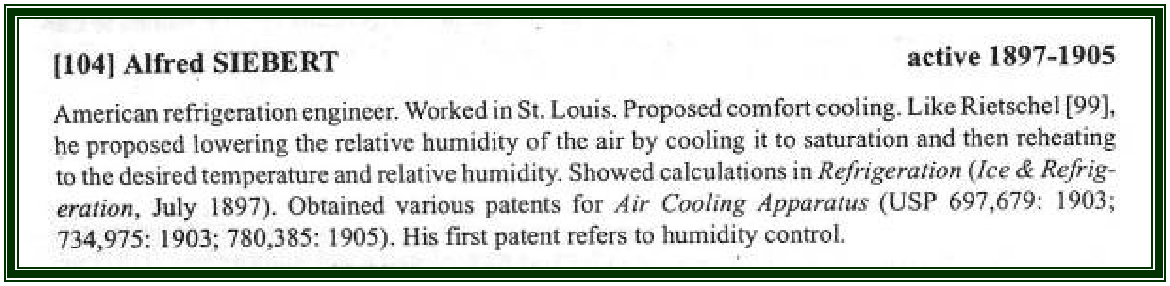
ALFRED SIEBERT
Active 1897-1905

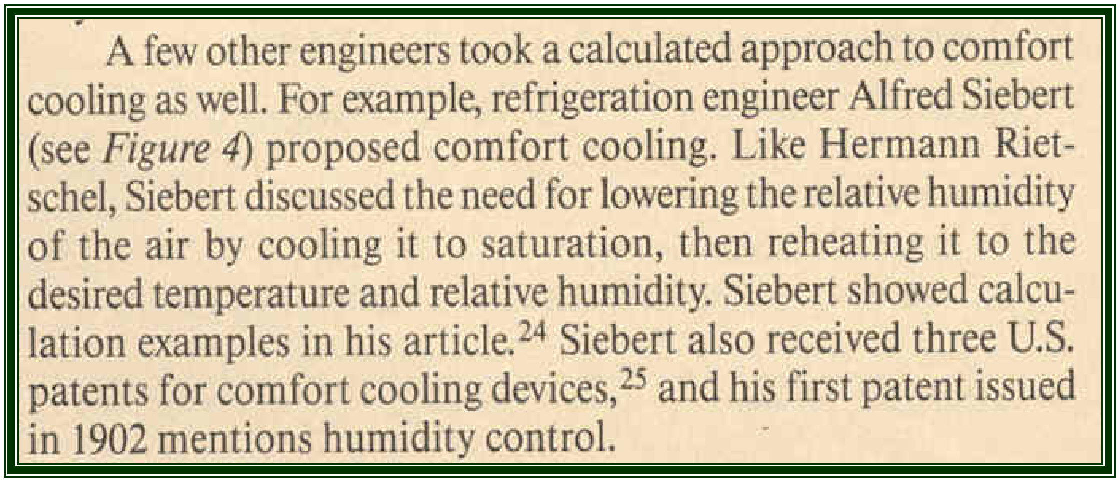
Refrigeration and Air Conditioning Engineer



[104] Alfred SIEBERT **active 1897-1905**

American refrigeration engineer. Worked in St. Louis. Proposed comfort cooling. Like Rietschel [99], he proposed lowering the relative humidity of the air by cooling it to saturation and then reheating to the desired temperature and relative humidity. Showed calculations in *Refrigeration* (*Ice & Refrigeration*, July 1897). Obtained various patents for *Air Cooling Apparatus* (USP 697,679: 1903; 734,975: 1903; 780,385: 1905). His first patent refers to humidity control.

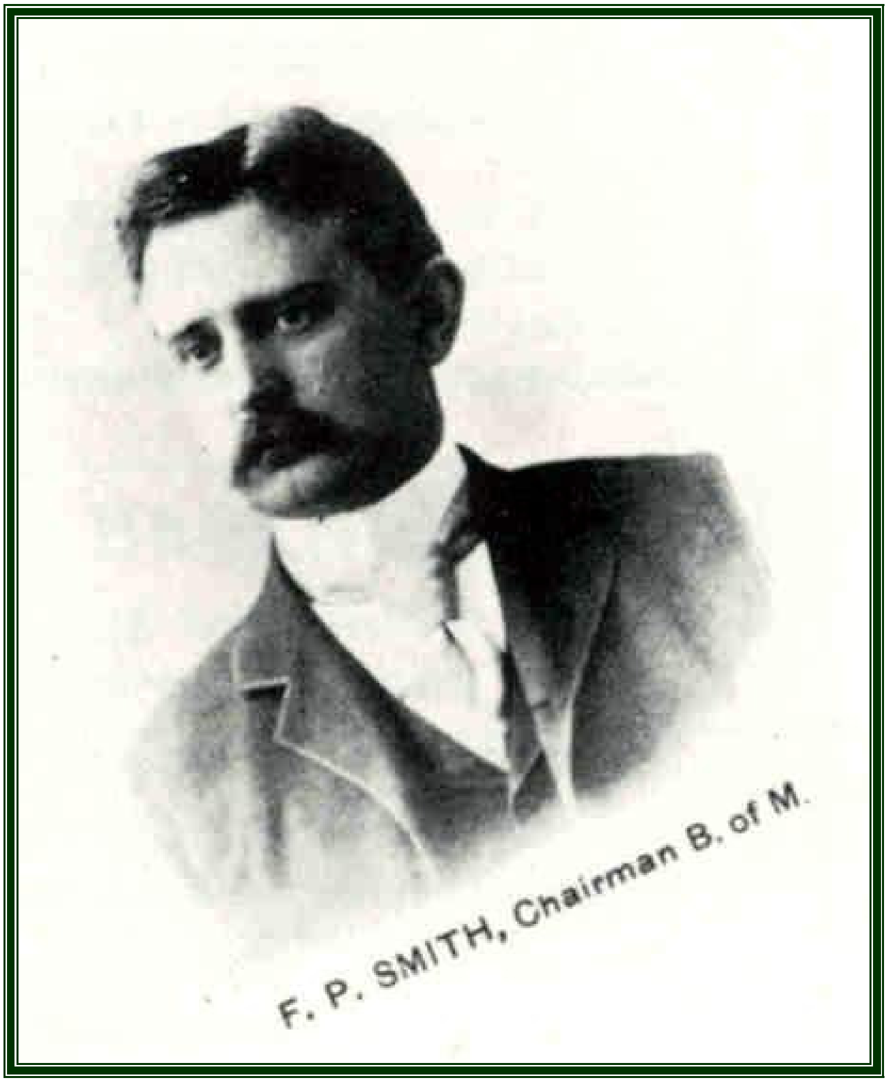
(Mini-biography from "The Comfort Makers," Brian Roberts, ASHRAE, 2000)



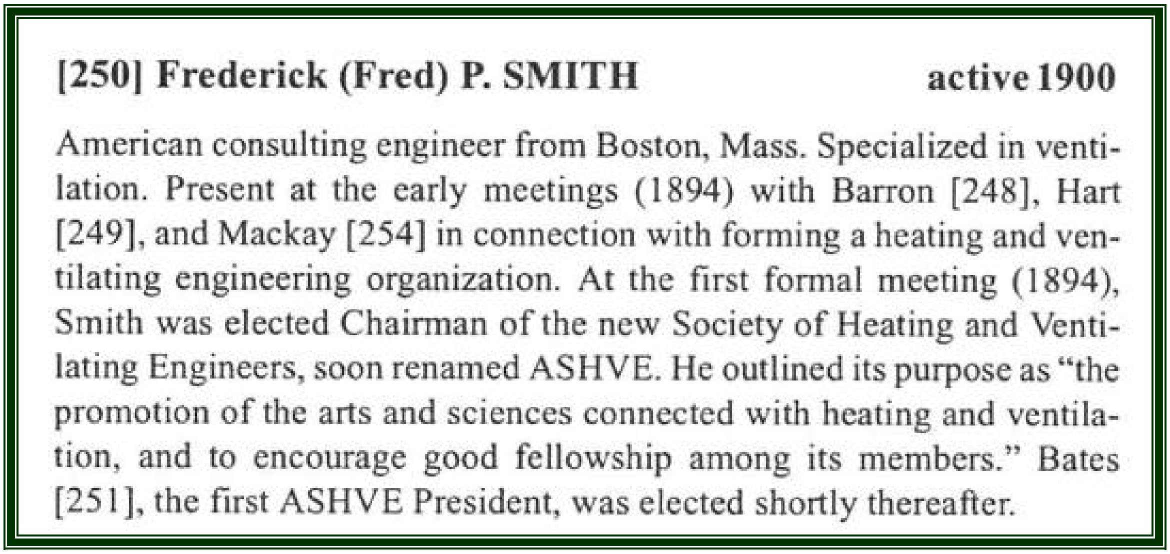
A few other engineers took a calculated approach to comfort cooling as well. For example, refrigeration engineer Alfred Siebert (see *Figure 4*) proposed comfort cooling. Like Hermann Rietschel, Siebert discussed the need for lowering the relative humidity of the air by cooling it to saturation, then reheating it to the desired temperature and relative humidity. Siebert showed calculation examples in his article.[24] Siebert also received three U.S. patents for comfort cooling devices,[25] and his first patent issued in 1902 mentions humidity control.

(From "The First 80 Years of Air Conditioning," Bernard A Nagengast,
ASHRAE Journal, January 1992)

FREDERICK P SMITH
Active 1900



Founding Member of the ASHVE in 1894



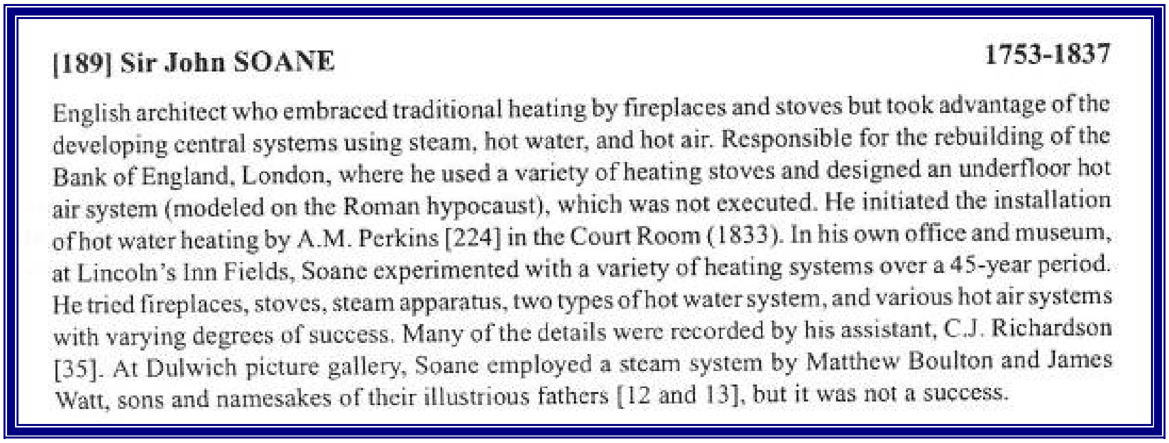
[250] Frederick (Fred) P. SMITH **active 1900**

American consulting engineer from Boston, Mass. Specialized in ventilation. Present at the early meetings (1894) with Barron [248], Hart [249], and Mackay [254] in connection with forming a heating and ventilating engineering organization. At the first formal meeting (1894), Smith was elected Chairman of the new Society of Heating and Ventilating Engineers, soon renamed ASHVE. He outlined its purpose as "the promotion of the arts and sciences connected with heating and ventilation, and to encourage good fellowship among its members." Bates [251], the first ASHVE President, was elected shortly thereafter.

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

Sir JOHN SOANE
1753-1837

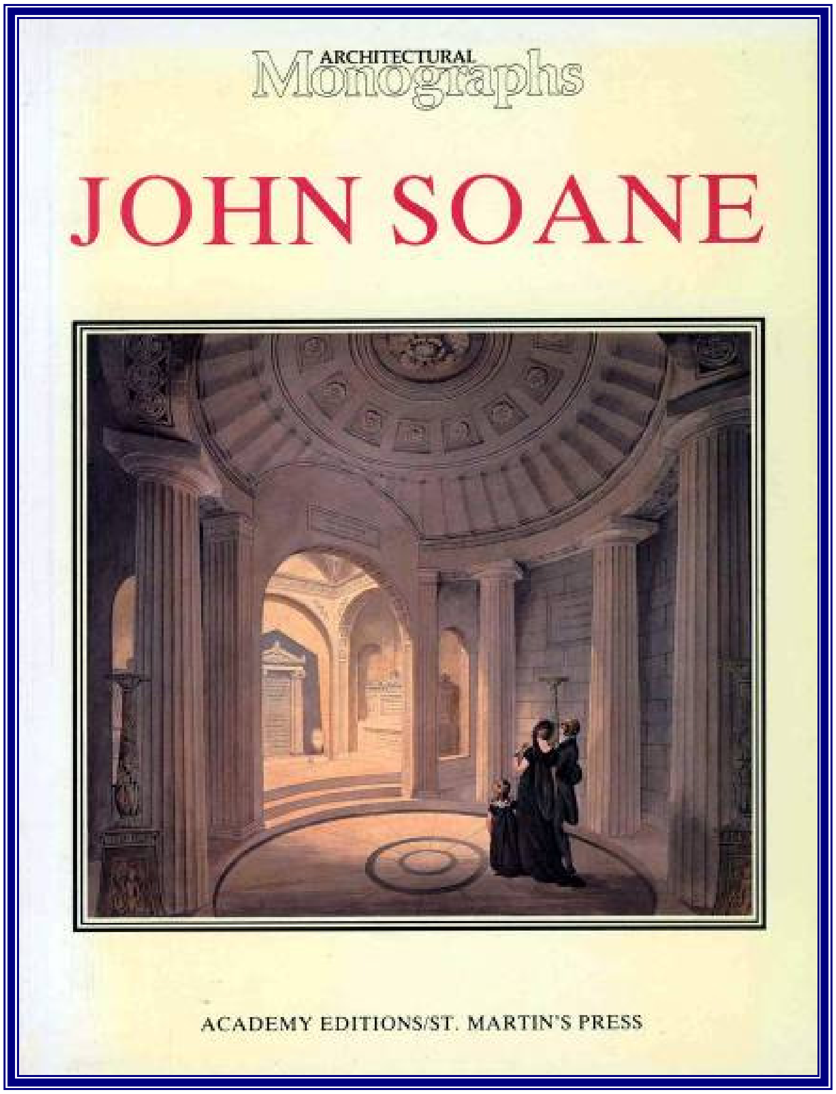
Architect Interested in Heating Systems



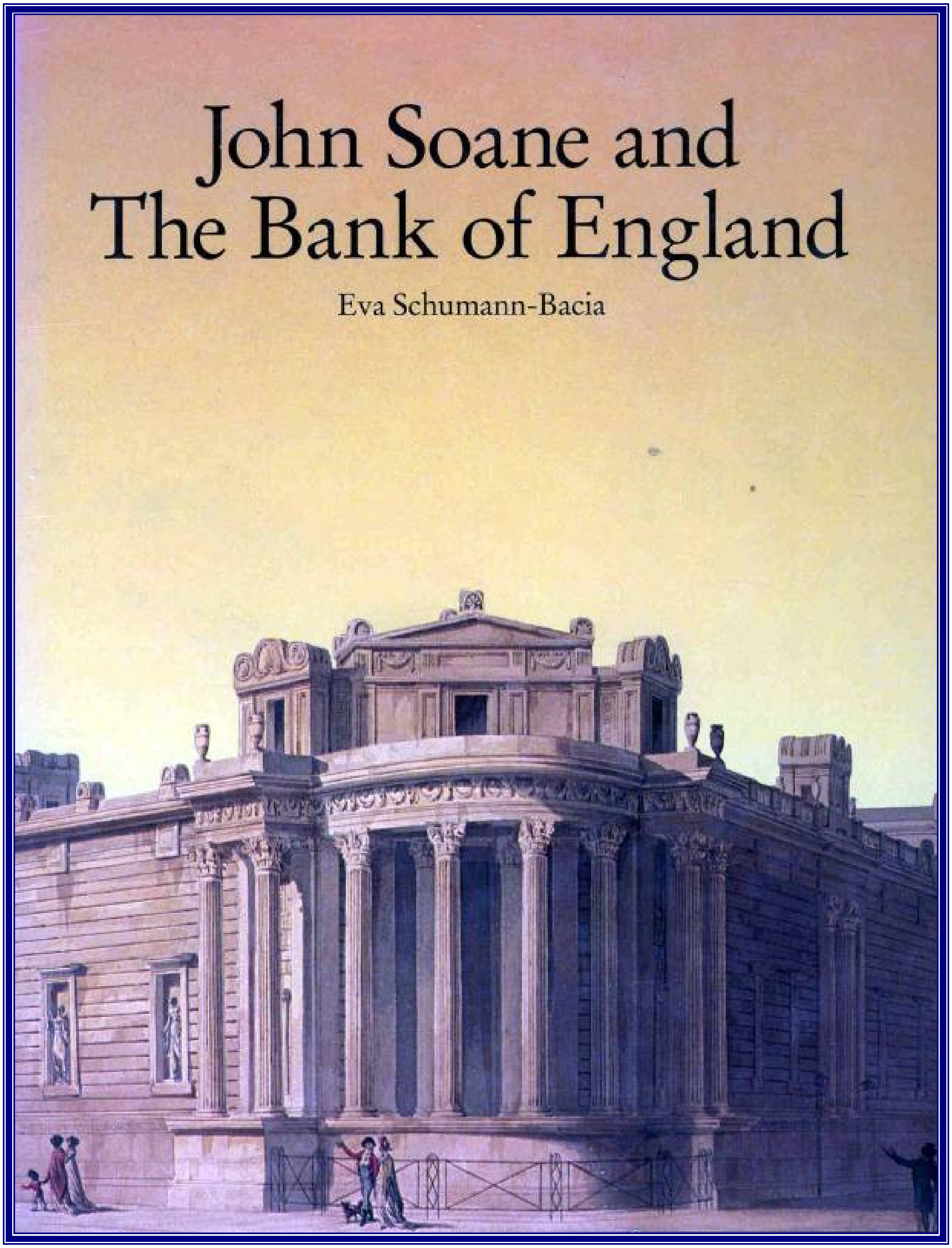
[189] Sir John SOANE **1753-1837**

English architect who embraced traditional heating by fireplaces and stoves but took advantage of the developing central systems using steam, hot water, and hot air. Responsible for the rebuilding of the Bank of England, London, where he used a variety of heating stoves and designed an underfloor hot air system (modeled on the Roman hypocaust), which was not executed. He initiated the installation of hot water heating by A.M. Perkins [224] in the Court Room (1833). In his own office and museum, at Lincoln's Inn Fields, Soane experimented with a variety of heating systems over a 45-year period. He tried fireplaces, stoves, steam apparatus, two types of hot water system, and various hot air systems with varying degrees of success. Many of the details were recorded by his assistant, C.J. Richardson [35]. At Dulwich picture gallery, Soane employed a steam system by Matthew Boulton and James Watt, sons and namesakes of their illustrious fathers [12 and 13], but it was not a success.

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



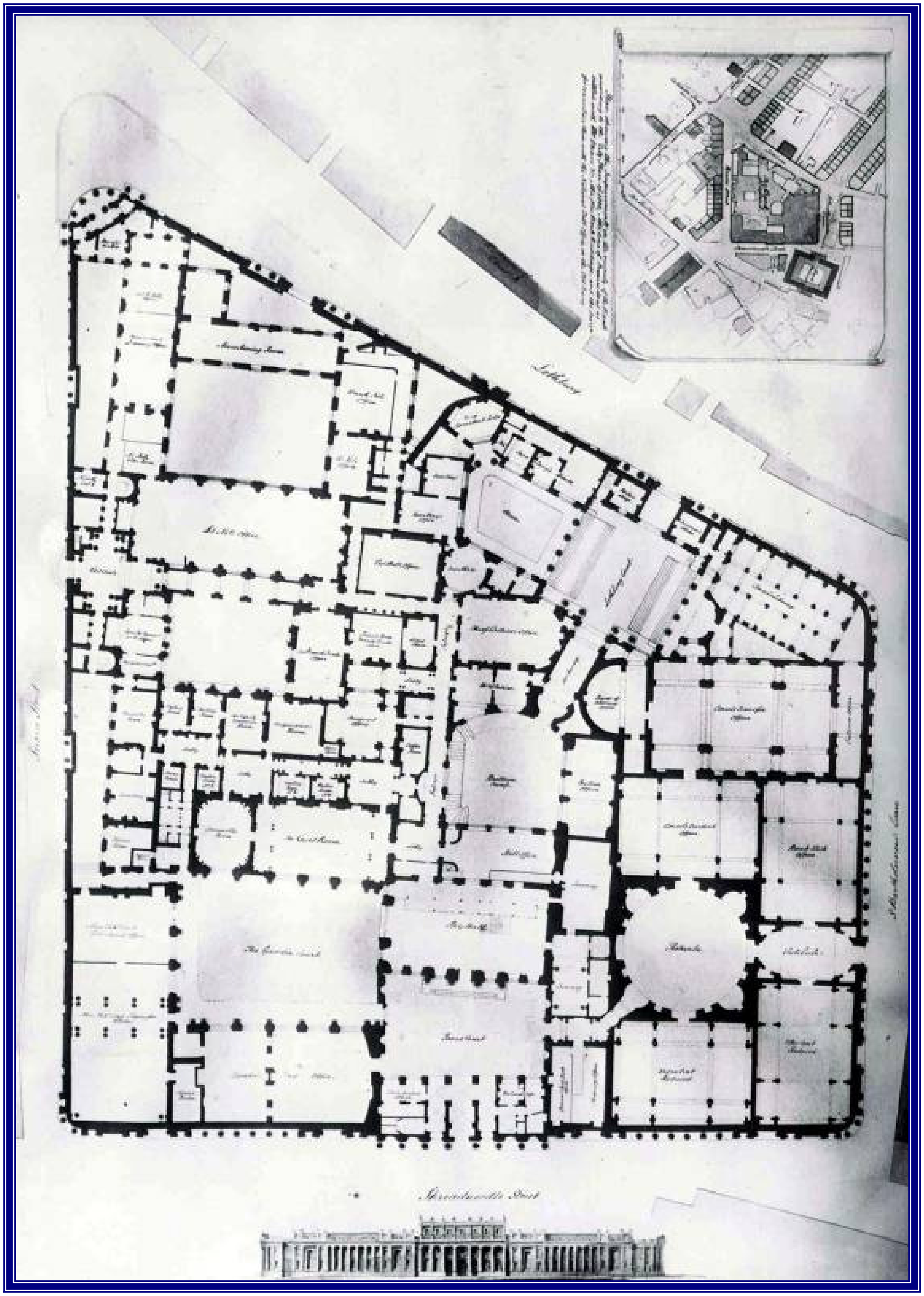
1983 (CIBSE Heritage Group Collection)



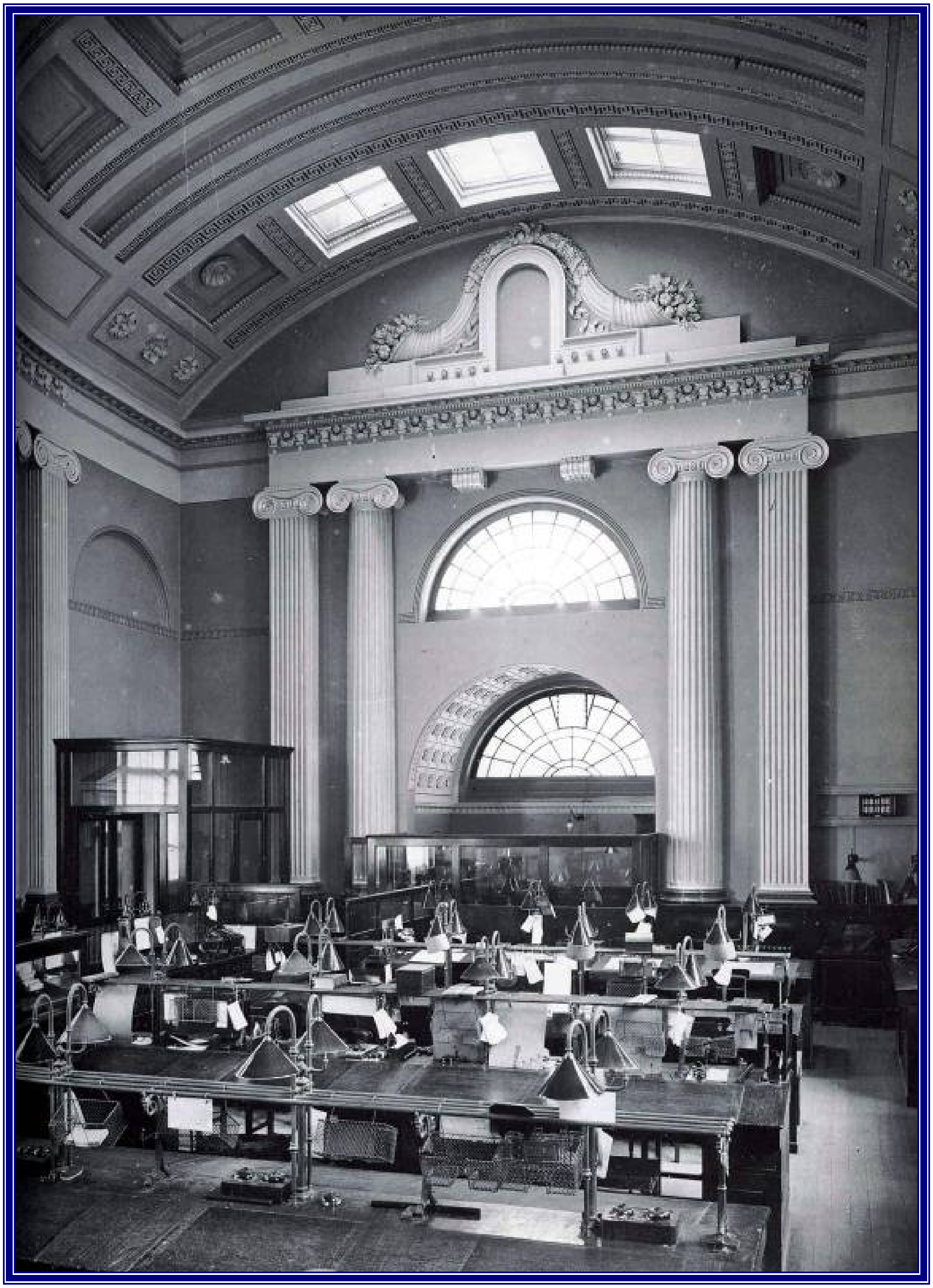
John Soane and
The Bank of England

Eva Schumann-Bacia

1991 (CIBSE Heritage Group Collection)



Plan of the Bank of England, London



The Old £5 Note Office, Bank of England

Heating Methods and Their Impact on Soane's Work: Lincoln's Inn Fields and Dulwich Picture Gallery

TODD WILLMERT Minneapolis, Minnesota

During the years of Sir John Soane's practice, there were tremendous advancements in central heating methods. Stoves and fireplaces were no longer the primary means of heating spaces as hot air, steam, and hot water systems were introduced and gained currency. Soane designed expressive stoves, and fireplaces remained especially important to him because of their cultural associations, but he also readily recognized the possibilities of central systems and utilized them as they became available. The result is a compelling dialogue between his architecture and the diversity of available heating strategies. To understand fully Soane's manipulation of space or design intent in such major works as Lincoln's Inn Fields and Dulwich Picture Gallery, it is critical to understand his awareness of heating methods and his expertise in addressing the architectural opportunities they offered.

SIR JOHN SOANE is justly renowned for his skilled use of natural light in such works as 12–14 Lincoln's Inn Fields and Dulwich Picture Gallery, but his other environmental considerations in these buildings have not been recognized. Of particular interest is his use of both traditional and modern heating methods. Fireplaces were an important element of his architecture because of their psychological connotations. Their domestic and cultural overtones could not be ignored. Soane's stove designs illustrate a wide range of expression. While Soane embraced traditional heating methods, he also took advantage of the central heating systems emerging during his career. Steam, hot water, and hot air systems—heating innovations developed in Great Britain during the industrial revolution—provided new means of controlling the thermal environment, and Soane recognized and exploited them for the comfort they afforded building occupants as well as for the design opportunities they presented.

Heating methods informed Soane's architecture profoundly in his residence at Lincoln's Inn Fields. Within a span of forty-five years, Soane employed fireplaces and stoves as well as three different types of central systems. Because of their domestic associations, fireplaces heated the residential rooms in the front of the house. Although mirrors and decorative planes in these rooms make them spatially complex through illusion, they are actually simple, contained chambers easily heated by fireplace. In contrast, the rich, layered spaces in the rear, the "rooms" of Soane's professional life, were heated centrally. Initially, these interlocking spaces were discrete rooms, some of which were heated by stoves or fireplaces, but they evolved to explore explicitly what is illusionary in the residential rooms. The professional spaces, because of their spatial complexity, were practicable only in light of modern heating technologies.

At Dulwich Picture Gallery, Soane investigated thermal control in a physical, sensory manner. He juxtaposed an unheated mausoleum, almshouses heated by fireplaces, and a centrally heated gallery to reinforce the building's programmatic elements. The unheated mausoleum was in direct contrast to the centrally heated galleries, creating a critical tension. The development of different thermal realms, a concept Soane reinforced through lighting and materials, was crucial to his intentions.

Before turning to a detailed analysis of Lincoln's Inn Fields or Dulwich Picture Gallery, however, it is necessary to outline innovations in heating in the late eighteenth and early nineteenth centuries and Soane's commentary on them. Soane's pioneering use of the heating technologies is more obvious when seen against this background. An examination of the Bank of England Stock Office, an early major project, will succinctly summarize Soane's interest in different heating methods and his command of both traditional and modern heating.

Soane's commentary on heating technologies and the historical context

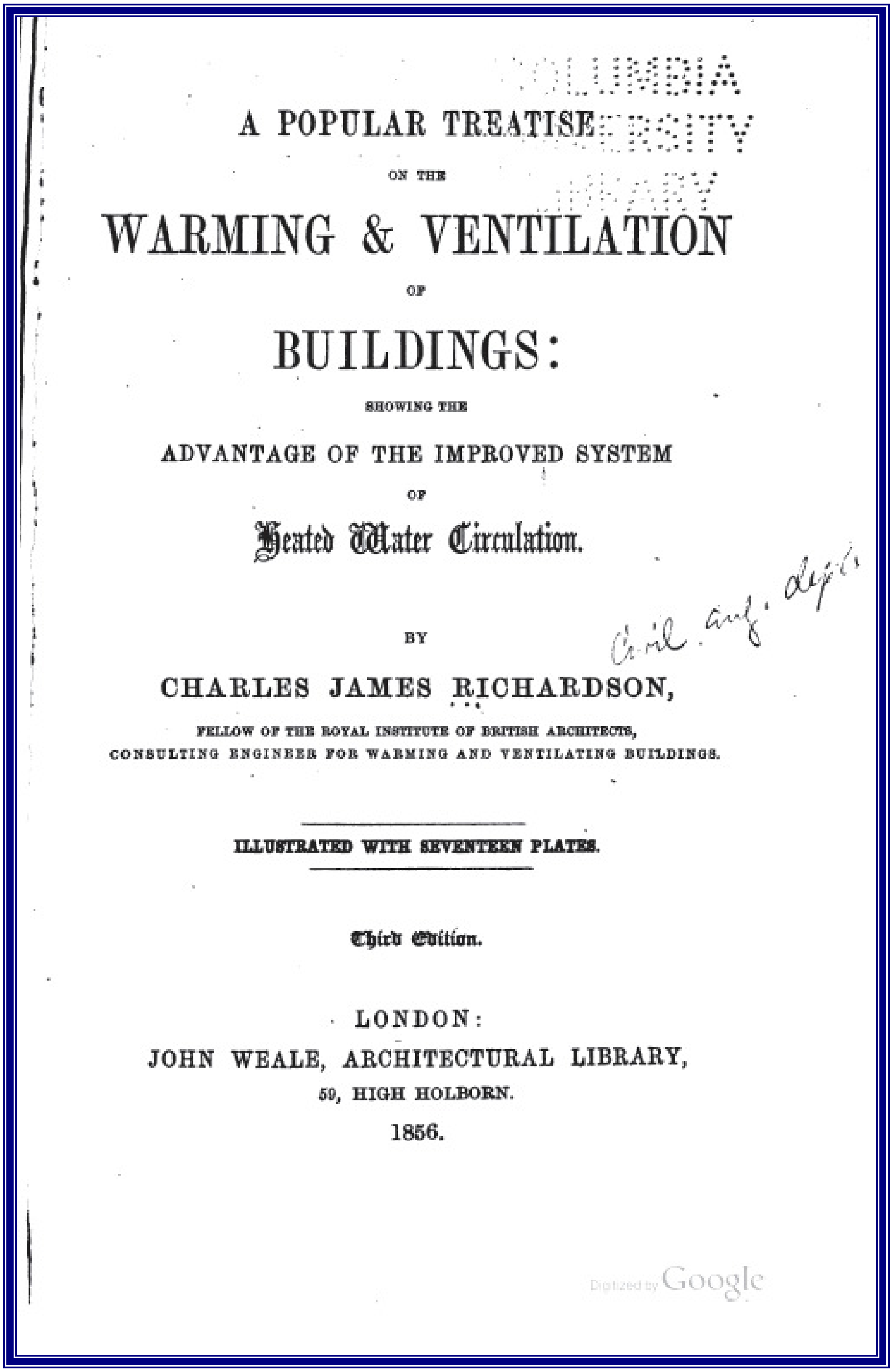
Soane's career, spanning from 1768 to 1835,[1] was a period of unparalleled innovation in central heating technologies. Two

Research for this study was made possible by a grant from the Reynolds Scholarship Program at Dartmouth College. The Samuel H. Kress Foundation provided funding for the study's images. At Sir John Soane's Museum, Margaret Richardson, Helen Dorey, Susan Palmer, and Christina Scull aided in the search for relevant documentary material. At Dulwich Picture Gallery, Giles Waterfield allowed me to examine records in his possession. Aside from their help in assembling documents, their insight into Soane's architecture contributed to this research. An earlier draft of this study was completed under the guidance of Dean Hawkes and Nick Baker. On this version, Kathleen James, Leon Satkowski, and Susan Ubbelohde offered substantiative criticism.

---

[1] Soane was born in 1753 and died in 1837. The title of Soane's *Memoirs* implies that his career was framed by the years 1768 and 1835.

The Soane Museum, 13 Lincoln’s Inn Field
Where Soane and his assistant C J Richardson experimented with many types of heating system



A POPULAR TREATISE
ON THE
WARMING & VENTILATION
OF
BUILDINGS:
SHOWING THE
ADVANTAGE OF THE IMPROVED SYSTEM
OF
Heated Water Circulation.

Civil. eng. dep

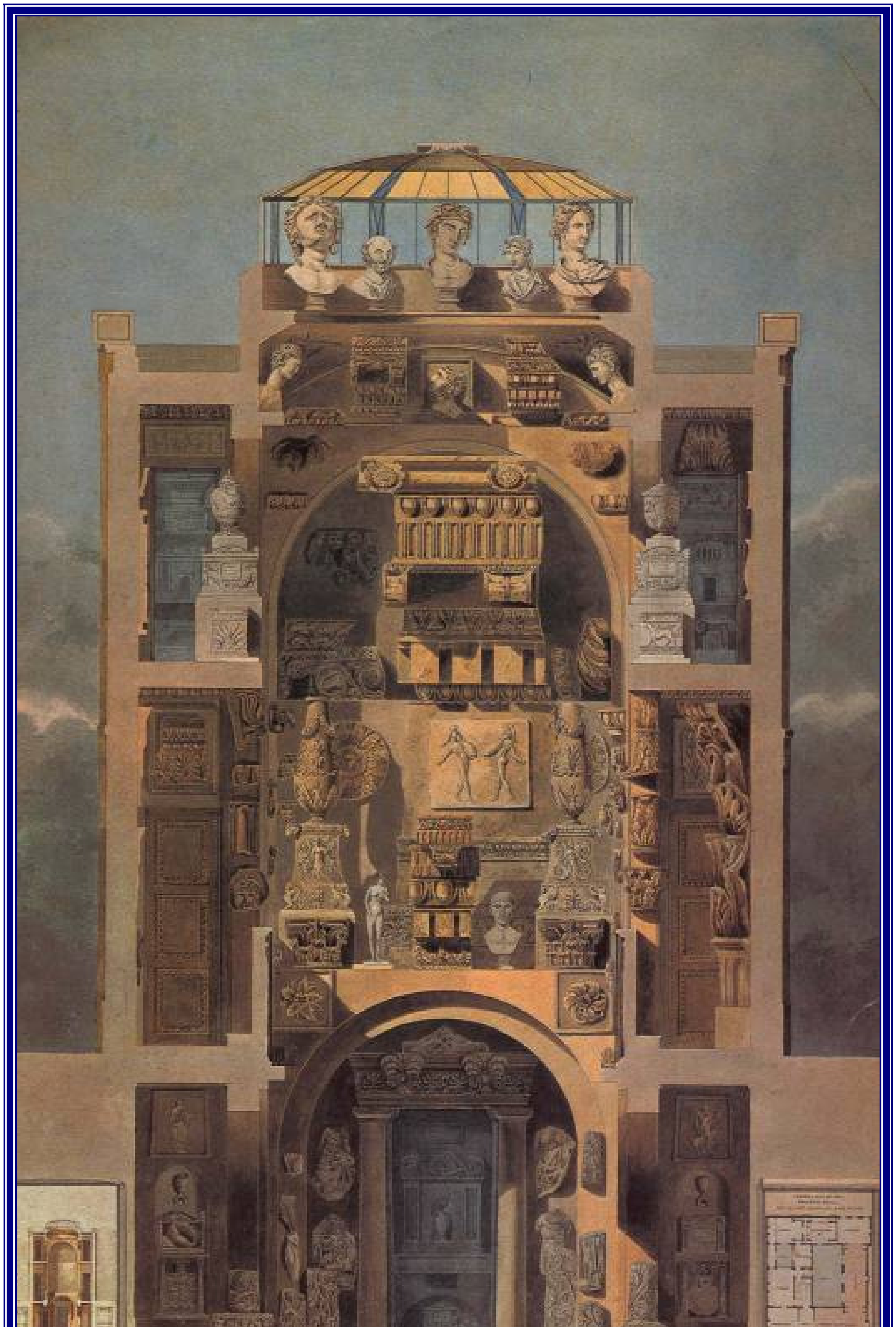
BY
CHARLES JAMES RICHARDSON,
FELLOW OF THE ROYAL INSTITUTE OF BRITISH ARCHITECTS,
CONSULTING ENGINEER FOR WARMING AND VENTILATING BUILDINGS.

ILLUSTRATED WITH SEVENTEEN PLATES.

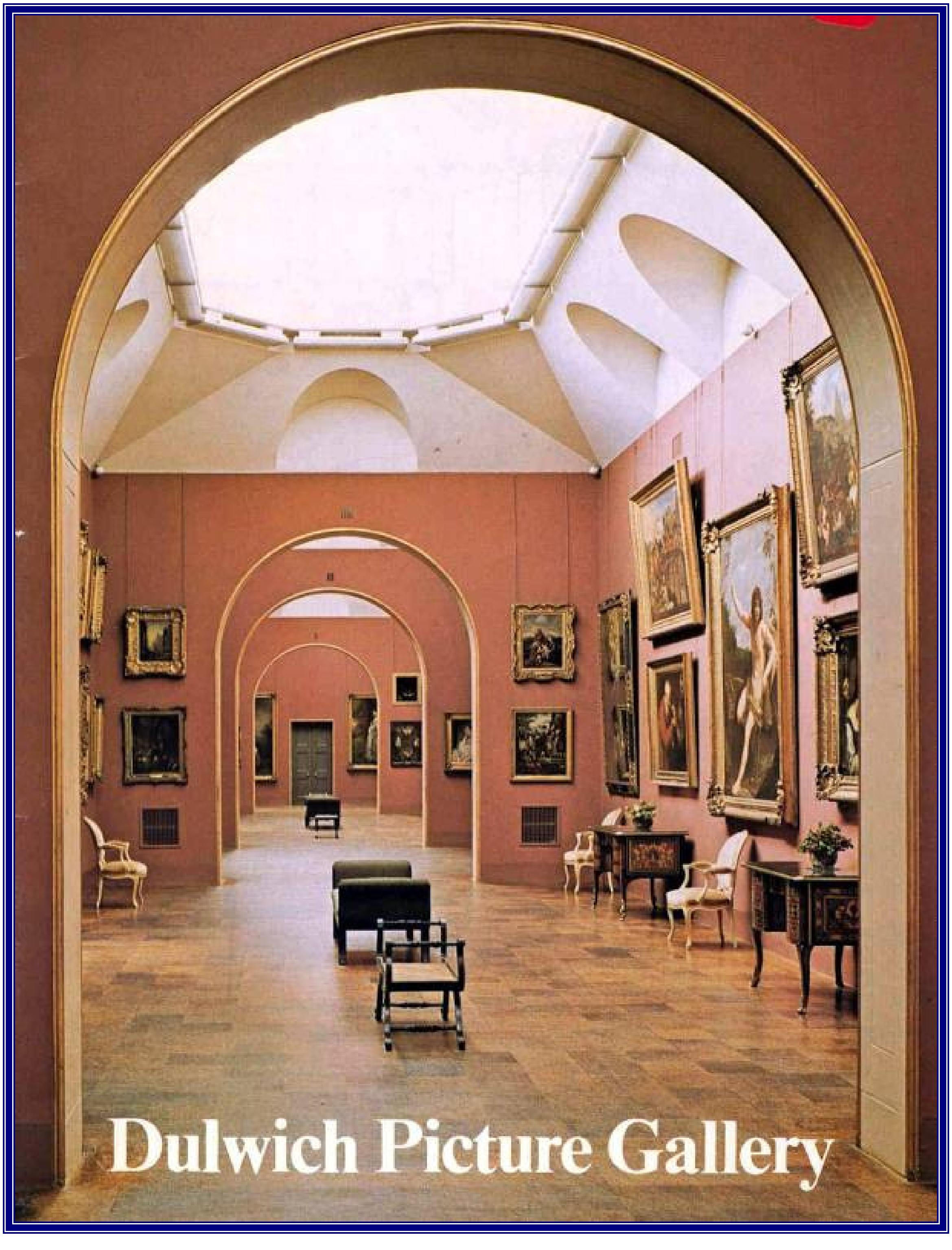
Third Edition.

LONDON:
JOHN WEALE, ARCHITECTURAL LIBRARY,
59, HIGH HOLBORN.
1856.

(Google Books)



The Dome: 13 Lincoln's Inn Field, painting of 1810

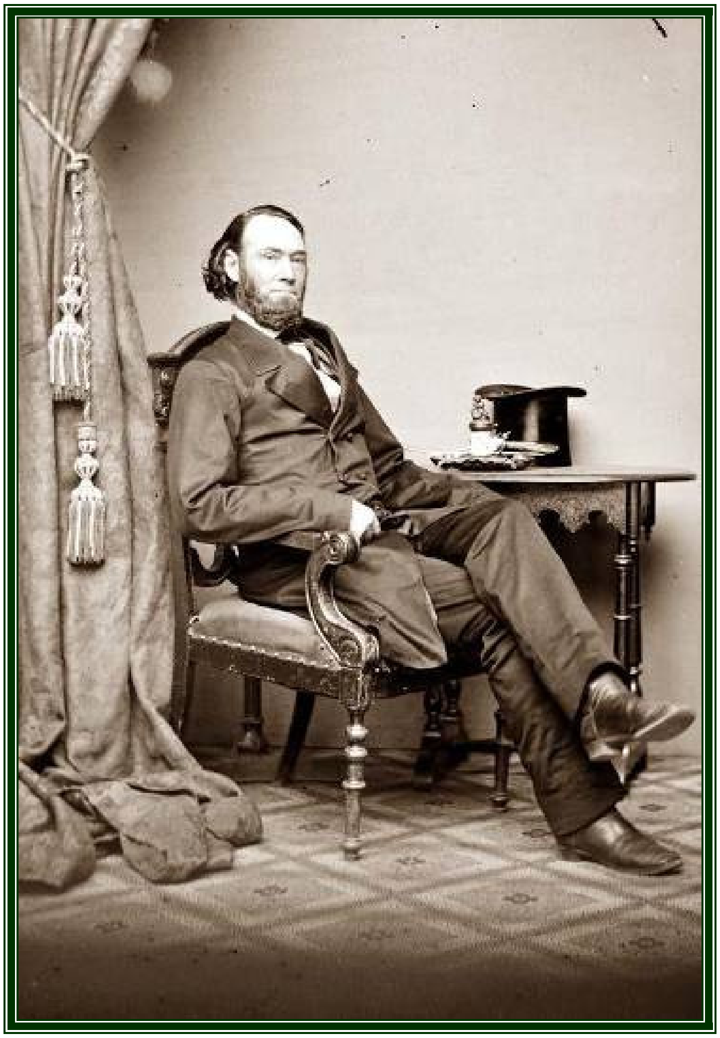


Dulwich Picture Gallery

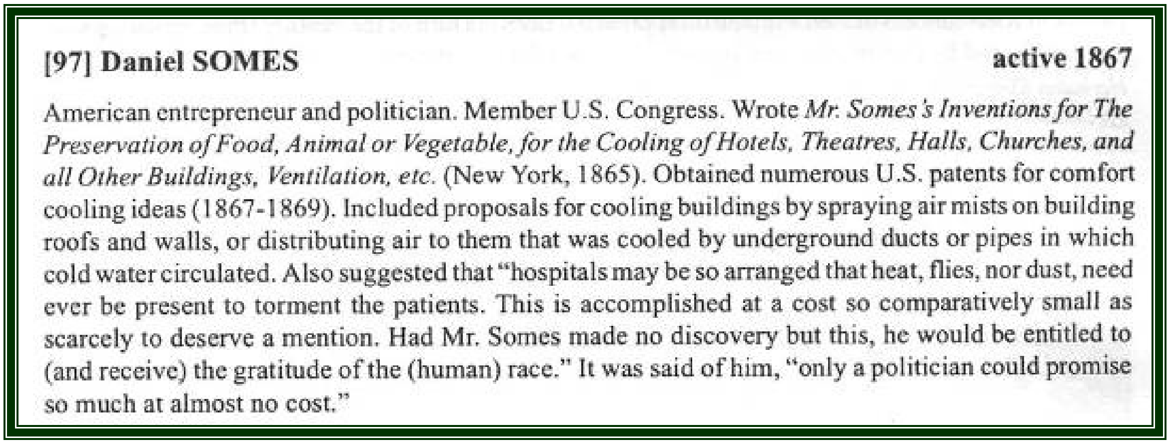
(CIBSE Heritage Group Collection)

19 Vista through the gallery at Dulwich. Photograph taken c. 1900, still with the original glazing of Soane's lantern.

DANIEL E SOMES
1815-1888



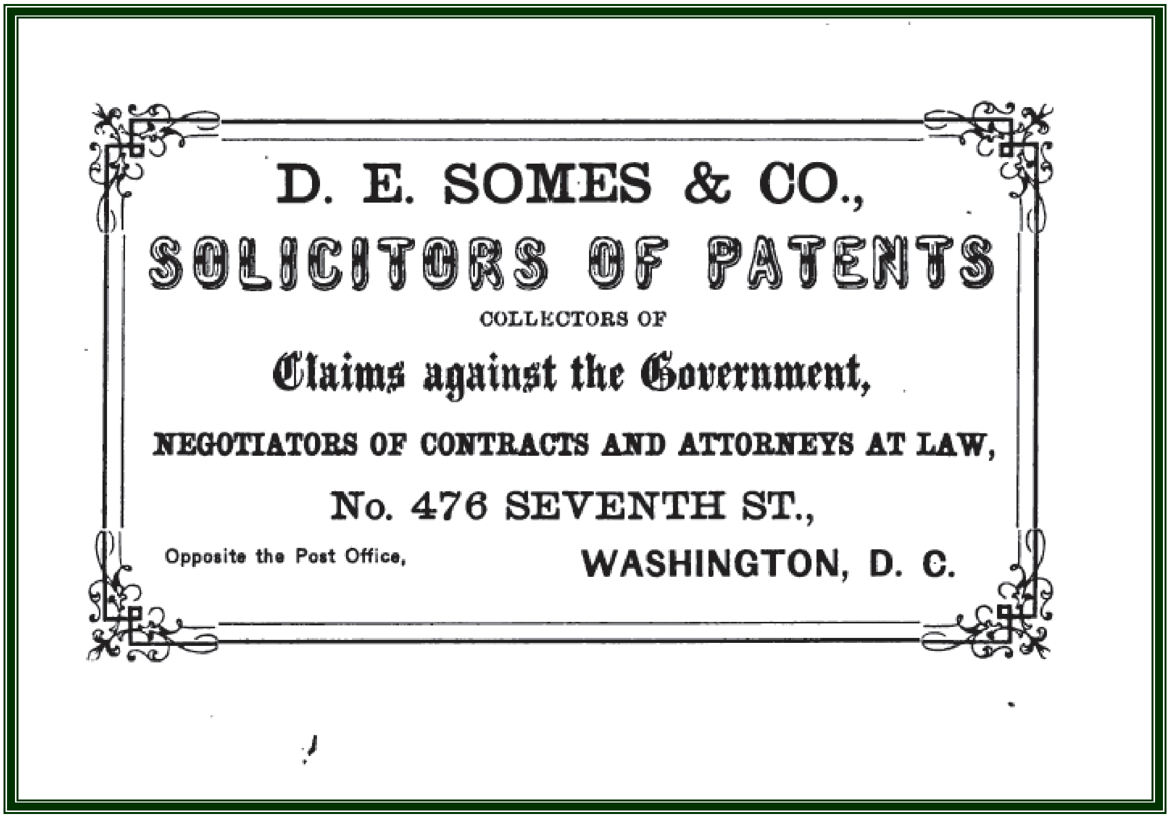
Air conditioning entrepreneur and politician



[97] Daniel SOMES **active 1867**

American entrepreneur and politician. Member U.S. Congress. Wrote *Mr. Somes's Inventions for The Preservation of Food, Animal or Vegetable, for the Cooling of Hotels, Theatres, Halls, Churches, and all Other Buildings, Ventilation, etc.* (New York, 1865). Obtained numerous U.S. patents for comfort cooling ideas (1867-1869). Included proposals for cooling buildings by spraying air mists on building roofs and walls, or distributing air to them that was cooled by underground ducts or pipes in which cold water circulated. Also suggested that "hospitals may be so arranged that heat, flies, nor dust, need ever be present to torment the patients. This is accomplished at a cost so comparatively small as scarcely to deserve a mention. Had Mr. Somes made no discovery but this, he would be entitled to (and receive) the gratitude of the (human) race." It was said of him, "only a politician could promise so much at almost no cost."

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



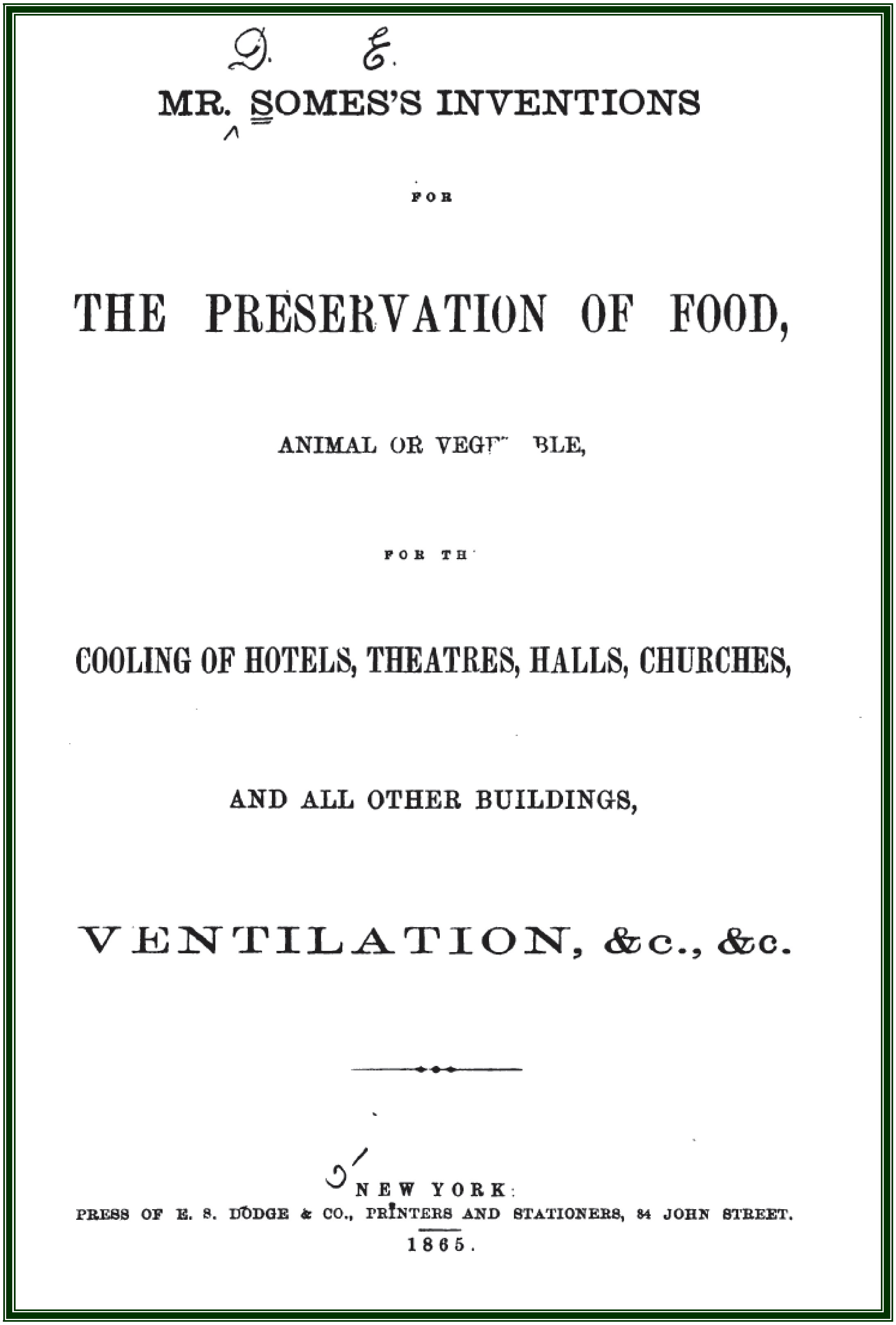
D. E. SOMES & CO.,
SOLICITORS OF PATENTS
COLLECTORS OF
Claims against the Government,
NEGOTIATORS OF CONTRACTS AND ATTORNEYS AT LAW,
No. 476 SEVENTH ST.,
Opposite the Post Office, WASHINGTON, D. C.

In the U.S., Daniel Somes obtained numerous U.S. patents for comfort cooling ideas during 1867-1869. Somes proposed cooling buildings by spraying air mists on building roofs and walls, or distributing air to them that was cooled by underground ducts, or pipes in which cold water circulated.[10] Somes also tried to sell his ideas by proposing organization of corporations to market the systems, perhaps showing that he was the first air conditioning entrepreneur.

For example, Somes proposed that "hospitals may be so arranged that heat, flies, nor dust, need never be present to harass and torment the patients. This is accomplished also at a cost so comparatively small as scarcely to deserve a mention. Had Mr. Somes made no discovery but this, he would be entitled to (and receive) the gratitude of the (human) race. But his inventions do not terminate here."[11]

Continuing to sound like a modern late-night TV commercial, Somes hyped his systems for cooling parlors, dining and sleeping rooms, churches and public halls, banking houses, stores, machine shops and offices. These fantastic promises can be understood in that Somes had been a member of the U.S. Congress; only a politician could promise so much at almost no cost. Despite his best efforts, there does not seem to be any other mention of Somes in the literature (see *Figure 1*).

(From "Heat & Cold: Mastering the Great Indoors," Barry Donaldson & Bernard Nagengast, ASHRAE, 1994)



D. E.

MR. SOMES'S INVENTIONS

FOR

THE PRESERVATION OF FOOD,

ANIMAL OR VEGETABLE,

FOR THE

COOLING OF HOTELS, THEATRES, HALLS, CHURCHES,

AND ALL OTHER BUILDINGS,

VENTILATION, &c., &c.

NEW YORK:
PRESS OF E. S. DODGE & CO., PRINTERS AND STATIONERS, 84 JOHN STREET.
1865.

(Google Books)

MR. D. E. SOMES' PLAN

FOR

Ventilating, Cooling and Heating the Capitol,

AND FOR

PURIFYING AND MOISTENING THE AIR.

To the Hon. Committee on Public Buildings.

This memorial is intended to call the attention of your honorable body to the following means of ventilating, cooling, and warming the United States Capitol, and of purifying and moistening the air before it is admitted to the halls.

By my method the temperature of the air to be supplied in hot weather is reduced as low as the temperature of the earth would be at a depth below the surface where the influence of the sun's rays is inappreciable. This depth varies in different localities, but the variation is due only to existing local causes, such for instance as the presence of a very cold or warm spring of water. It is known from observations made in deep cellars, wine and ale vaults, and other excavations, that a depth of from twenty to forty feet below the surface would be sufficient to insure a temperature of from 45 to 50 deg. Fahr. during the hottest days in summer.

This fact is taken advantage of in my method to secure a thorough ventilation to any large edifice by supplying a copious flow of pure and cold air during the summer, and pure warm, and sufficiently moistened, air during the winter.

Sheet No. 1 represents an outline ground plan of the Capitol, and of the structures I have adopted in my method of supplying the building with pure and warm or cold air.

Sheet No. 2, figs. 1 and 3, exhibit cross sections of the chamber C, sheet 1, and different arrangments of the coils of cooling or heating pipes. The coils, as in fig. 1, being arranged to allow passage through the centre of the chamber, or as in fig. 3, to allow such passage on each side, near the walls of the chamber. Fig. 2 is a sketch showing partially the longitudinal arrangement of the pipes in the coil, which will be better understood by reference to sheet 3.

Fig. 4 is a cross-section of the air duct B, seen in dotted lines on sheet 1, and showing a water-pipe E, suspended near the crown of the arch, the use of which will be hereafter more fully described.

Sheet No. 3, fig. 5, shows a longitudinal vertical section through the centre of the chamber C, showing the manner of arranging the coil of pipes for *cooling* purposes.

Sheet No. 4 shows an elevation and section of one of the towers A, seen in plan—sheet 1.

Sheet No. 5, figs. 1, 2, and 3, shows devices for moistening the air that has been *heated* for *warming* purposes, and which will be more particularly referred to hereafter.

A, A, sheet 1, are two towers about twenty-five feet square, placed at some distance from the building, say two hundred yards, or thereabouts, from the building to be ventilated, and sufficiently far apart to be symmetrical with their altitudes, which should be great enough to permit their tops to be above impurities and to be in a stratum of cool air. This height I have assumed to be about one hundred and seventy feet. These towers are the supply pipes to the ventilating apparatus, and are constructed with hollow walls so as to have a non-conducting air space between their inner and outer surfaces in order that the sun's rays shall have no power to heat the air on its downward passage. The air space in the thickness of the walls still further tends to operate as a cooler on the inside walls by the action of evaporation going on within it, from the bottom, where it is closed and naturally damp, to the top, where it is open to the atmosphere.

The wells or inner chambers of the towers are open to a free ingress of air at top and extend down below the surface of the ground to a distance of about thirty feet, where they each communicate with an air duct (B, seen in dotted lines sheet 1, and in section sheet 4) extending horizontally from the bases of the towers, in as great a circuit as may be desired, to the chambers of the ventilating fans in the building.

The floors of the ducts will be on a level with the bottoms of the tower shafts and they will have a height and width of, say, twelve feet, and be covered with a semi-circular arch resting upon walls of a proper thickness. At the ends of the ducts nearest the fan-rooms in the building they will be enlarged into chambers C, (see sheet 1, 2, and 3.)

The bottoms of these chambers are twelve or fifteen feet lower than the floors of the ducts, while their tops are on about the same line as those of the ducts, and they are about forty feet in length by, say, twenty in width. Other chambers similarly constructed may be made in other parts of the ducts should they be required, though they are not deemed necessary.

The use of these chambers is to receive coils of water pipes, so arranged that they—passing through the masonry into the chamber at that end of it which is furthest from the fan—shall be carried directly down to the bottom of the chamber, thence along the whole length of the bottom towards the fan, *through a medium of extreme coolness*, when it will rise to the crown of the chamber, or near it, and be returned so as to descend again to the bottom of the chamber, in the same vertical transverse plane as the first descent, and be carried again along the bottom of the chamber to rise and be returned as before; and the coils necessary for such a flow of water are continued and repeated until as much cooling surface of water-pipe is obtained as room will permit, leaving space for passage either through the middle or at the sides. (See sheets 2 and 3.) The cooling medium, in the bottom of the chamber through which the pipes pass, may be a reservoir or spring of water, whose coolness is due to its natural depth below the surface, or a packing of ice which would last, under such conditions, for a long time.

That portion of the coil which is vertical at each end of the chamber is composed of different lengths of pipe placed alternately, so as to make two rows of different altitudes extending along the upper part of the chamber C, for the purpose of having the pipes in which the *cooled* water flows distributed, as much as possible, throughout the air flowing through the duct and chamber. To this end, therefore, three or more rows of horizontal pipes may be built in the top of the coil, the vertical pipes being in lengths to suit. It will be seen, moreover, that the coil is so arranged that the water cooled in its passage along the bottom of, the chamber shall rise in those vertical pipes that are nearest to the fan, and descend in the pipes at the opposite end of the chamber. This is in order that the air may have as little space as possible to traverse to reach the fan after being in contact with the coldest pipes. What little elevation of temperature the water may receive in its passage along the top pipes of the coil will be reduced again as it flows along the bottom, through the cooling medium. The arrows on sheet 3 indicate the direction of the flow of water through the coil. After the water has passed through the coil, it may either be made to flow through other coils or pass directly to purposes of ornament or use.

If deemed expedient, a coil of cooling-pipe may be introduced into the fan chamber to act on the air in its passage from the fan to the rooms where it is required, though it is not contemplated that such an arrangement will be at all necessary.

A pipe (E, fig. 4, sheet 2,) larger in diameter than the pipes composing the coil extends along the duct, near its crown, through which water flows towards the tower. This pipe is perforated at intervals along its length with minute holes, through which the water jets, in fine spray, still further conducing to a low temperature of air in the duct. Near the tower the pipe is carried through the masonry, and the water is conveyed away for useful or ornamental purposes, or it may be returned to pass into the coil of smaller pipes, which are located in the chambers C, before being thus used. The fan may be dispensed with if a system of water-pipes be placed within the towers. The air, being cooled by said pipes, becomes condensed and, consequently, heavier. It falls and forces its way through the ducts into the halls, to be cooled where the air is warm and light. If the outward draft flue or eduction passage for the warmer air be connected with a chimney or heated flue, or be in close proximity thereto, the amount of cooled air flowing in from the ducts will be increased.

In cold weather the pipes of the coil, instead of being charged with cold water, are converted into steam pipes, for the purpose of *heating* the air supplied by the ducts B. The temperature of the earth below raises the temperature of the air to about 50°. A very small amount of steam, therefore, is required to bring it up to the requisite point, say 68°. Steam may also be used, as is now done, in the passage from the fan to the room. The waste steam may be, moreover, used to keep up the temperature to the proper degree, and counterbalance the loss by radiation through the walls of the air channel, as well as to aid in preventing the air from becoming too dry, the amount of moisture supplied to the heated air being regulated as hereinafter set forth.

The air is moistened by the use of pipes introduced either into the subterranean air ducts or into the chambers above the fan, which pipes have short and minutely perforated branches, through which the steam may jet. Fig. 1, sheet 5, shows a portion of such pipe, with some branches connected with the main pipe by stop-cocks. As the air passes along, over, and among the pipes it absorbs the vapor, and becomes moistened thereby.

When steam would not be available for use in moistening the heated air a vat of water is placed in the duct, over which the air must pass on its way to or from the fan, and a revolving drum or cylinder—deriving its motion from the same power as the fan—covered with cloth, sponge, felt, or other suitable material, is placed in the vat so that as it revolves there shall be constantly presented a wet surface to the current of heated air as it flows. (See fig. 2, sheet 5.) In fig. 3, same sheet, is shown, in section, a modification of the revolving drum or cylinder, the peculiar construction of which secures a much greater surface for moistening the air than is obtained in a plain cylinder like fig. 2. Spray jets of warm water may be thrown through the air in the duct, which, as it passes, will collect moisture therefrom.

A smooth metallic glass or glazed earthen vessel, supplied from a water-cooler, or from the system of cold water-pipes hereinbefore described, or by any other effective mode, and placed within said room, will denote the amount of moisture contained in the air by the "sweat" or condensed vapor accumulated on the surface of the said vessel. The temperature of the vessel should be noted, in order that the regulation may be satisfactory.

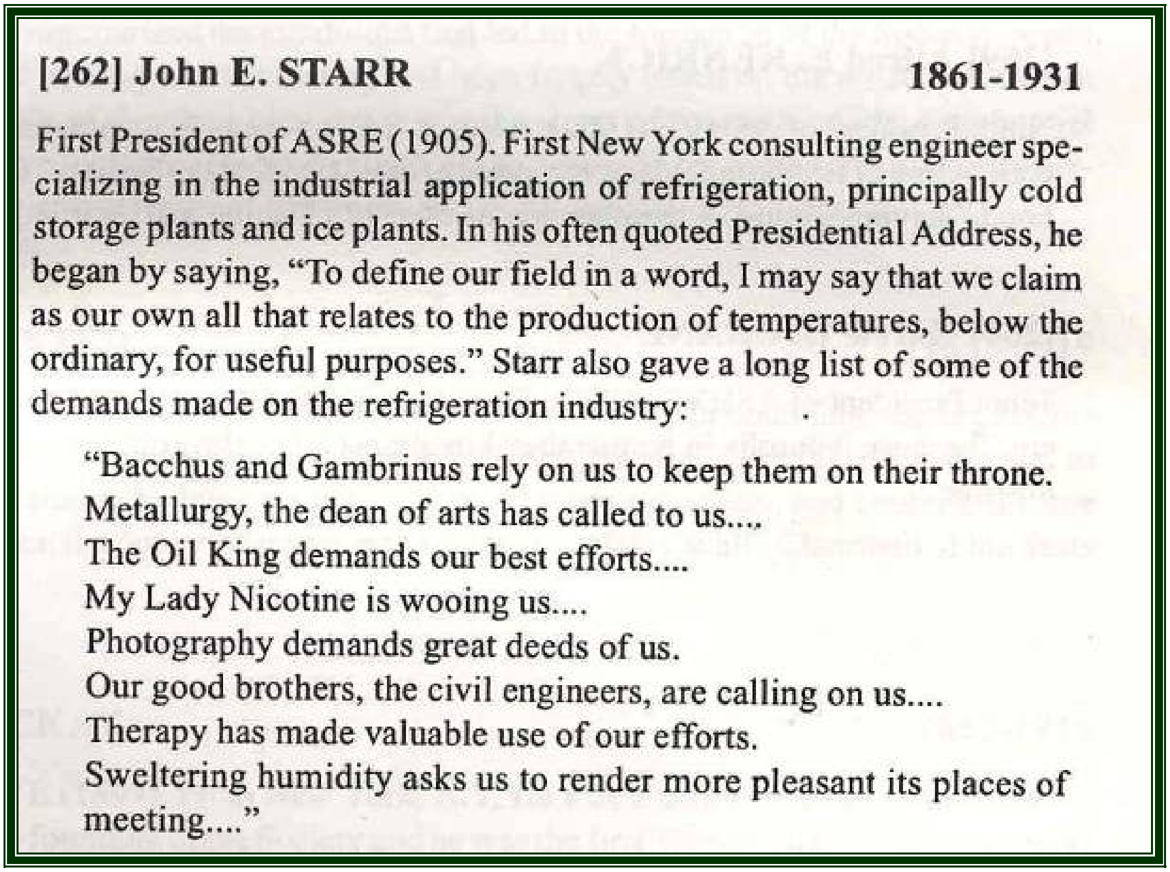
The roof of the House and Senate Chambers being of single glass, the rays of the sun necessarily produce intense heat in those halls during the hottest days in summer, while in winter cold is admitted, varying with the temperature of the atmosphere without. To prevent this evil in a great degree, I propose to have a series of glass roofs or ceilings, one above the other, separated by only a few inches, so as to leave non-conducting air spaces between them. These air chambers should be tight enough to prevent a circulation or change of air within them. A few inches above the upper glass roof a transparent cover or roof, made of cloth, or other suitable material, and painted white, may be placed to mitigate the heat of the sun's rays. A free circulation of air between the glass and said covering should be allowed. Of course, this covering should be firmly held in place against destruction or injury from heavy winds and storms. This may be done by constructing a frame similar to window sash, and, after placing and stretching the cloth upon it, strong strips should be screwed or otherwise fastened upon the frame, so that the cloth shall be held between them in panels or squares. As air is a non-conductor and glass a poor one, the object of excluding heat and cold, while light is admitted, will be accomplished by the adoption of this or a substantially equivalent device.

Respectfully submitted,
D. E. SOMES,
476 *7th street.*

WASHINGTON, D. C., *Jan.* 28, 1867.

JOHN E STARR
1861-1931

1st President ASRE in 1905

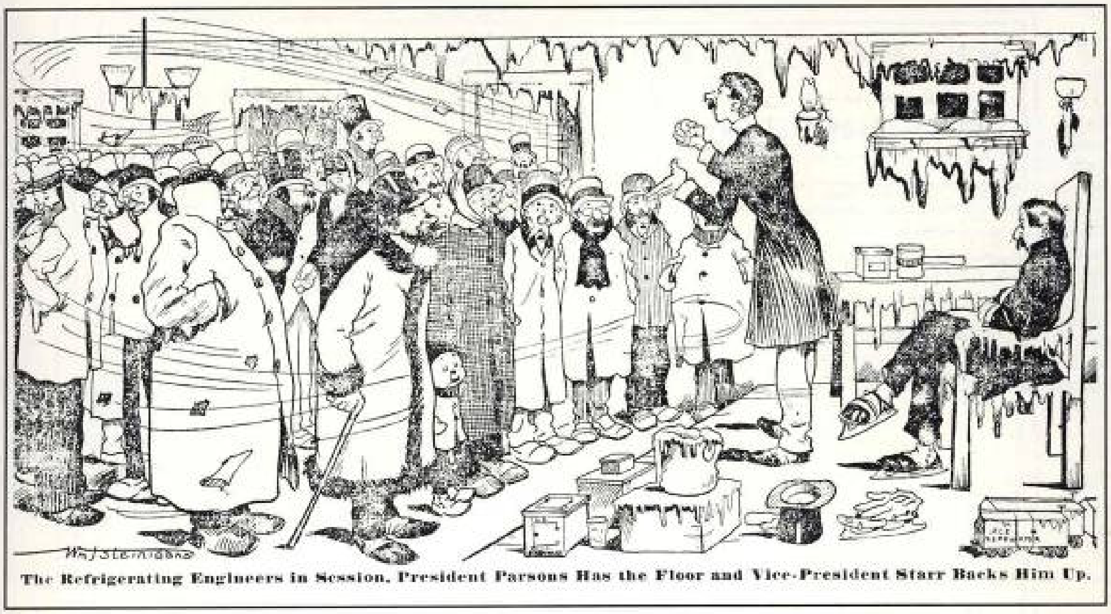


[262] John E. STARR **1861-1931**

First President of ASRE (1905). First New York consulting engineer specializing in the industrial application of refrigeration, principally cold storage plants and ice plants. In his often quoted Presidential Address, he began by saying, "To define our field in a word, I may say that we claim as our own all that relates to the production of temperatures, below the ordinary, for useful purposes." Starr also gave a long list of some of the demands made on the refrigeration industry:

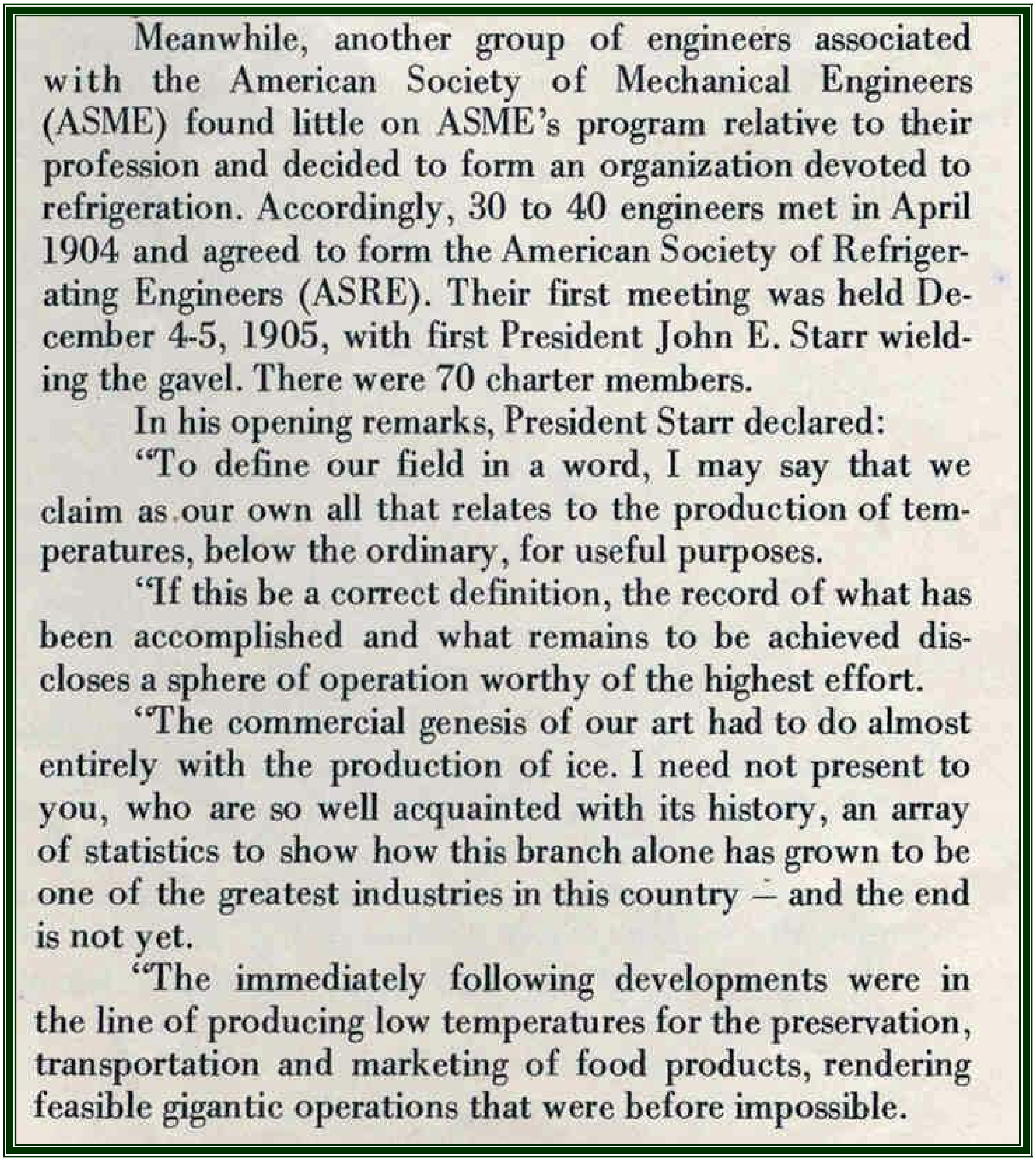
> "Bacchus and Gambrinus rely on us to keep them on their throne.
> Metallurgy, the dean of arts has called to us....
> The Oil King demands our best efforts....
> My Lady Nicotine is wooing us....
> Photography demands great deeds of us.
> Our good brothers, the civil engineers, are calling on us....
> Therapy has made valuable use of our efforts.
> Sweltering humidity asks us to render more pleasant its places of meeting...."

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



The Refrigerating Engineers in Session. President Parsons Has the Floor and Vice-President Starr Backs Him Up.

Figure 9-28 *Editorial cartoon (from* The New York World, *December 10, 1905, and reprinted in* Ice and Refrigeration, *December 1905, p. 297).*



Meanwhile, another group of engineers associated with the American Society of Mechanical Engineers (ASME) found little on ASME's program relative to their profession and decided to form an organization devoted to refrigeration. Accordingly, 30 to 40 engineers met in April 1904 and agreed to form the American Society of Refrigerating Engineers (ASRE). Their first meeting was held December 4-5, 1905, with first President John E. Starr wielding the gavel. There were 70 charter members.

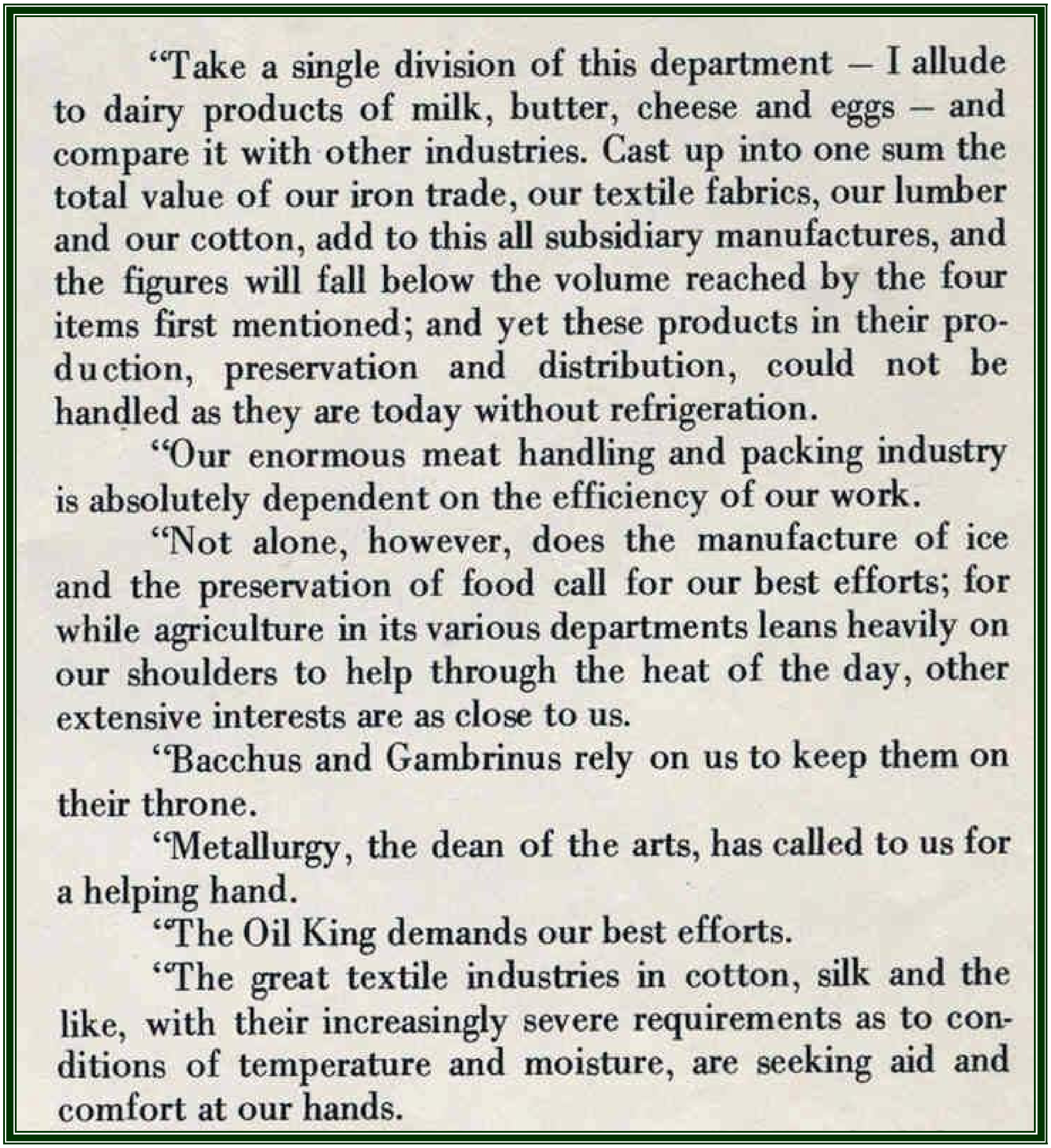
In his opening remarks, President Starr declared:

"To define our field in a word, I may say that we claim as our own all that relates to the production of temperatures, below the ordinary, for useful purposes.

"If this be a correct definition, the record of what has been accomplished and what remains to be achieved discloses a sphere of operation worthy of the highest effort.

"The commercial genesis of our art had to do almost entirely with the production of ice. I need not present to you, who are so well acquainted with its history, an array of statistics to show how this branch alone has grown to be one of the greatest industries in this country – and the end is not yet.

"The immediately following developments were in the line of producing low temperatures for the preservation, transportation and marketing of food products, rendering feasible gigantic operations that were before impossible.



“Take a single division of this department – I allude to dairy products of milk, butter, cheese and eggs – and compare it with other industries. Cast up into one sum the total value of our iron trade, our textile fabrics, our lumber and our cotton, add to this all subsidiary manufactures, and the figures will fall below the volume reached by the four items first mentioned; and yet these products in their production, preservation and distribution, could not be handled as they are today without refrigeration.

“Our enormous meat handling and packing industry is absolutely dependent on the efficiency of our work.

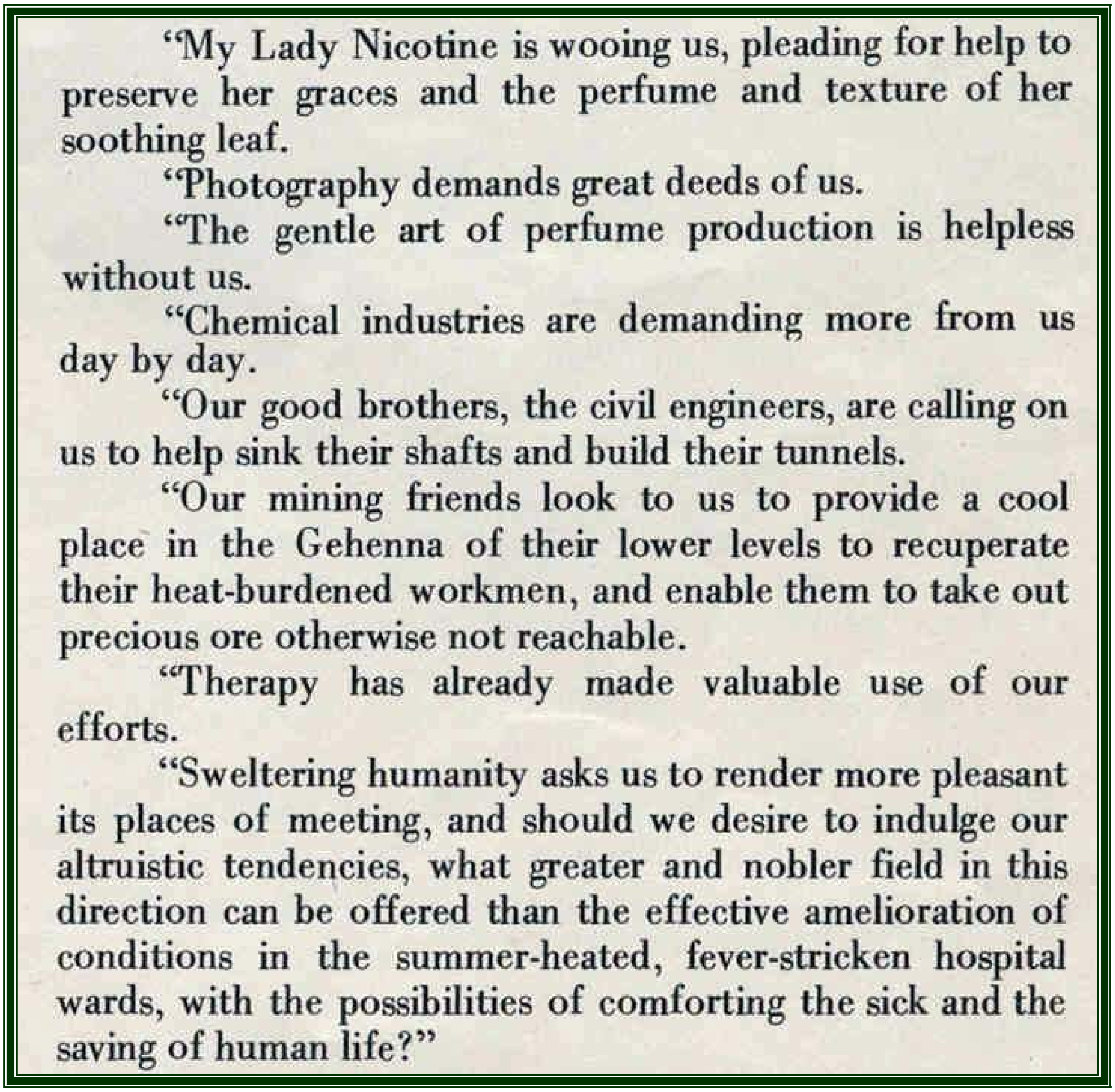
“Not alone, however, does the manufacture of ice and the preservation of food call for our best efforts; for while agriculture in its various departments leans heavily on our shoulders to help through the heat of the day, other extensive interests are as close to us.

“Bacchus and Gambrinus rely on us to keep them on their throne.

“Metallurgy, the dean of the arts, has called to us for a helping hand.

“The Oil King demands our best efforts.

“The great textile industries in cotton, silk and the like, with their increasingly severe requirements as to conditions of temperature and moisture, are seeking aid and comfort at our hands.



"My Lady Nicotine is wooing us, pleading for help to preserve her graces and the perfume and texture of her soothing leaf.

"Photography demands great deeds of us.

"The gentle art of perfume production is helpless without us.

"Chemical industries are demanding more from us day by day.

"Our good brothers, the civil engineers, are calling on us to help sink their shafts and build their tunnels.

"Our mining friends look to us to provide a cool place in the Gehenna of their lower levels to recuperate their heat-burdened workmen, and enable them to take out precious ore otherwise not reachable.

"Therapy has already made valuable use of our efforts.

"Sweltering humanity asks us to render more pleasant its places of meeting, and should we desire to indulge our altruistic tendencies, what greater and nobler field in this direction can be offered than the effective amelioration of conditions in the summer-heated, fever-stricken hospital wards, with the possibilities of comforting the sick and the saving of human life?"

(Text from "ASHRAE: A Chronicle of Progress,"
J H Cansdale, ASHRAE Journal, June 1969)

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(From Ice & Refrigeration, 1905)

Refrigeration

By JOHN E. STARR[1]

UP TO the beginning of the present century the bulk of the refrigeration was furnished by means of natural ice, but about the middle of the past century it became apparent that ice could be produced by machinery perhaps cheaper than it could be obtained from natural sources, and machine-made refrigeration offered such favorable possibilities in the control of temperature of lower degrees and control of moisture content that a wider definition became appropriate, and the word "refrigeration" has not only included the production of temperature below the ordinary surroundings, but the control of other air conditions at low temperatures, especially with respect to moisture content.

Mechanical refrigeration is largely used for the production of ice, and such ice is subdivided into small lots and presents itself to the consumer as a representative of the machine.

The ancients found by accident and practice that the partial vapor tension of water was sufficient to cause it to make a part of the atmospheric pressure and that to do so water would have to evaporate fast enough to take up heat enough to make ice even when surrounded by a temperature above freezing. Singularly enough, this early method of centuries ago is made use of in our most modern small machine. In the 18th and 19th centuries some very small operations were conducted using frigorific solutions and even to the present day this commercially impractical method is proposed occasionally.

Early Developments

After this first appearance, the industry of ice making rapidly developed and reached the dignity of a well-developed business by 1900 and by 1904 had reached the rather imposing production tonnage of 10 million tons in the United States. The history of the earlier development of cold storage and use in other arts was contemporaneous with the development of ice making and by 1904 there were nearly one hundred million cubic feet in cold storage and perhaps more in breweries and the use of refrigeration in other trades and industries was well established. There were beginnings in the 18th and 19th centuries, but little was generally heard of mechanical refrigeration till its commercial birth about 1860 or 1870. In the early part of the 18th century attempts were made at the production of refrigeration mainly by freezing mixtures.

Edmond Carré exhibited at the Paris Exposition in 1867 a small machine principally used for partially freezing water in bottles, or "carafes frappées," much used in Paris from 1862 to 1869. This apparatus suitable for carafes sold for about $120 complete and for 12 flasks at about $180. At the same exhibition in 1867 Ferdinand Carré exhibited a small alternating machine like the small alternating machine of the present day only better designed. For an apparatus making about $2^{1}/_{2}$ lb. of ice in one operation, he received $56. For a 5-lb. apparatus he charged $81. He also showed a continuous absorption machine of about 8 tons refrigerating capacity making nearly 5 tons of ice, which operated very much as the modern absorption machine and was fully as efficient.

About 1868 the Popp air-compressor central plant and pipe line was started in Paris, and by 1892 had reached a capacity of 10,000 hp. The exhaust air could have a temperature as low as —132 deg. fahr., and many refrigerators were cooled by using it.

The first large practical ammonia machine was produced in 1873 by Dr. Linde, and was built on truly scientific lines. In 1887 Dr. Linde erected a 100-ton plant in England. Singularly enough, what are now regarded as the latest methods were employed in this plant. One half of it was raw-water and the other half distilled-water production.

From 1870 to 1900 little was generally known of the properties of ammonia, which fluid was usually employed. In 1889–1890 there was much activity in building ice plants in New York City. Several 100- and 150-ton plants were built at that time, but none were very successful commercially except the one built by the De La Vergne Refrigerating Company, which company had already had large experience in brewery work. Rule of thumb largely prevailed, and blueprints were scarce.

Exact data on the properties of NH_3 were needed in order that truly scientific apparatus might be produced and its approach to the ideal ascertained. Up to 1913 only a few scattered figures were available. Mollier in Germany went far in this direction by the publication of his entropy charts, but DeVolson Wood's tables on the properties of ammonia published in 1913 were about the first available to the practical refrigerating engineer. His name stands out as a leader in thermodynamics in America.

About the same time Prof. J. E. Denton and Prof. D. S. Jacobus contributed practical data for use in working with ammonia. Later on Professors Goodenough and Mosher produced a very complete set of tables. In 1916, F. G. Keyes and R. S. Brownlee, as the result of their painstaking and scientific work at the Massachusetts Institute of Technology, published their invaluable tables.

After the publication of Keyes and Goodenough's tables, the American Society of Refrigerating Engineers,

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[1] Consulting Engineer; President, Starr Engineering Co., New York, N. Y. Mem. A.S.M.E. Mr. Starr has been active in refrigeration since 1878, and has made special studies in cold-storage practice. He has received the medal of the Franklin Institute which is awarded for "the most important invention of the year." He has prepared and published tables of the properties of ammonia solutions, and is the author of several works and many technical articles on refrigeration, cold-storage insulation, and the like. He is an honorary member of the American Society of Refrigerating Engineers.

(From Mechanical Engineering, April 1930)

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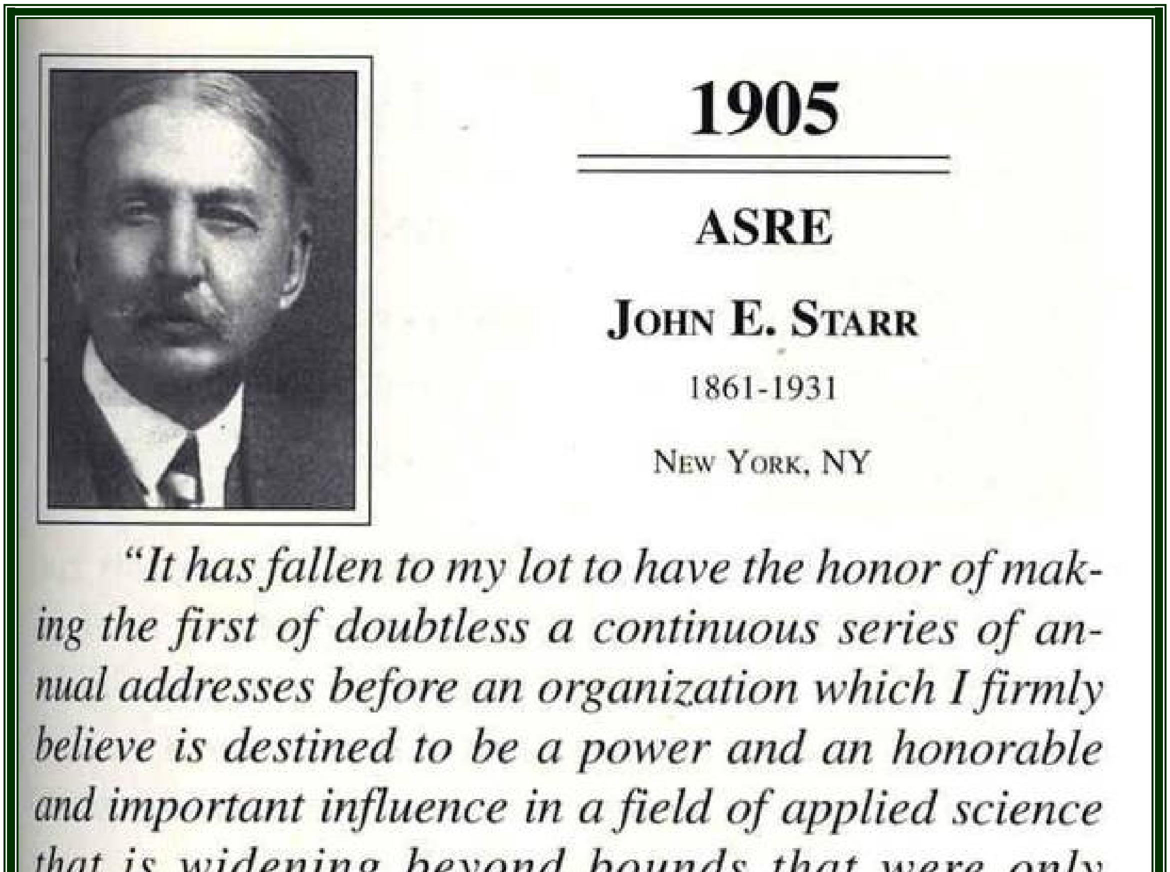

1905

ASRE

JOHN E. STARR

1861-1931

NEW YORK, NY

"It has fallen to my lot to have the honor of making the first of doubtless a continuous series of annual addresses before an organization which I firmly believe is destined to be a power and an honorable and important influence in a field of applied science that is widening beyond bounds that were only dreamed of two decades ago." (p. 37, *ASRE Trans.*, 1905)

(From "Proclaiming the Truth, ASHRAE, 1995)