EDWARD P BATES
1844-1919

1st President ASHVE in 1894

[251] Edward P. BATES **1844-1919**

First President of ASHVE (1894). Bates was a contractor from Syracuse, N.Y. In his Presidential Address, Bates concluded, "In order to carry out the objects of the Society, we shall need, first, the hearty cooperation of all its members; we shall need, further, a practical, intelligent devotion to the purpose for which we are organized. With these points carefully covered by each member, there is a work before us, which never has been thoroughly done, but will be accomplished by the members of this Society, to the credit and the good of the race."

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

1894

ASHVE

EDWARD P. BATES

1844-1919

SYRACUSE, NY

"I now charge you, as you love the cause in which you have so recently launched your bark, to look well to your applications for membership, as the growth and perpetuity of this society rests upon this fully as much as on any other proposition." (p. 1, *H&V*, Feb. 1, 1895,)

(From "Proclaiming the Truth," ASHRAE, 1995)

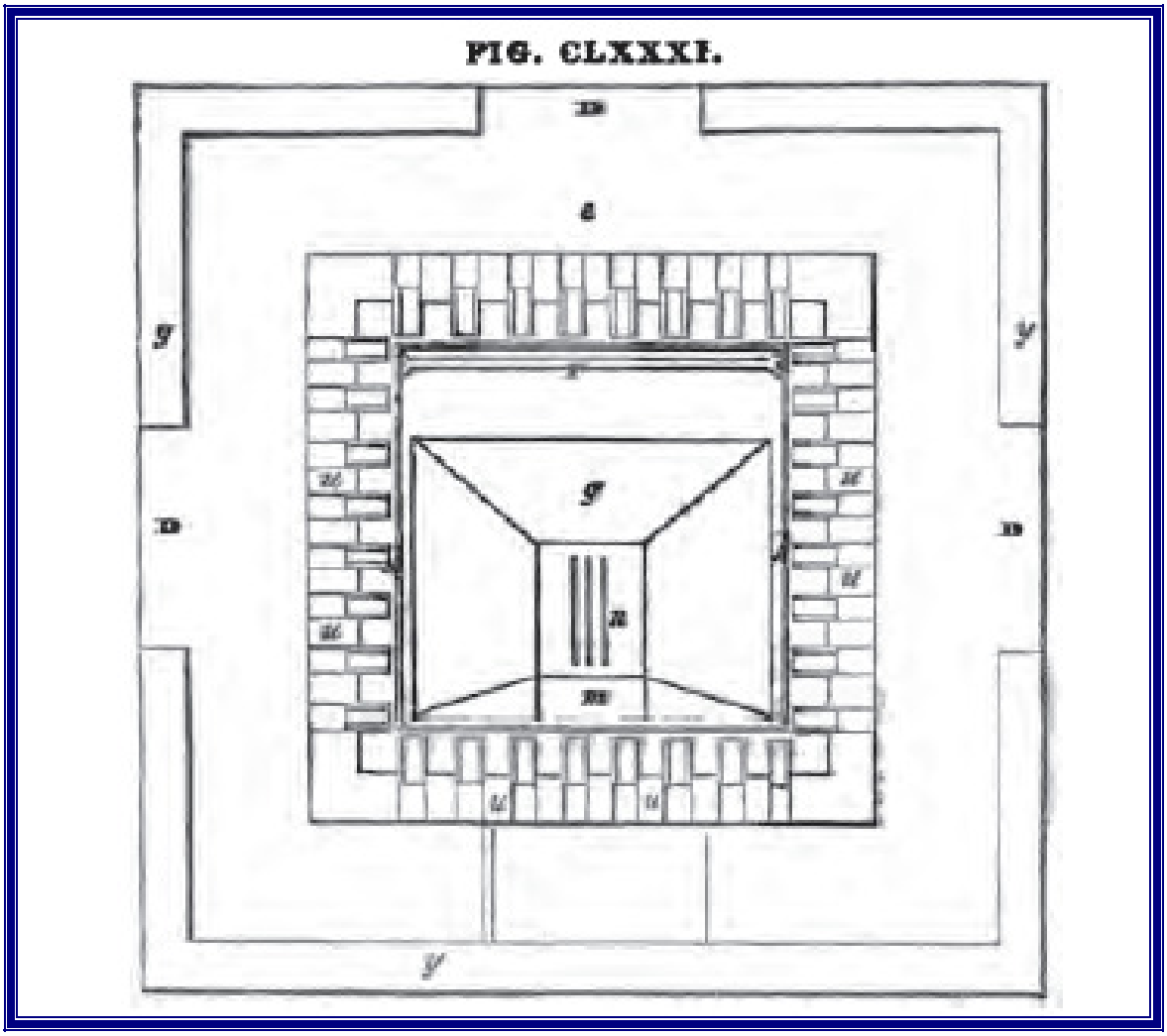
WALTER BERNAN
(ROBERT MEIKELHAM)
Active mid-19th century

Historian of heating & ventilation
No portrait has so far been discovered

[28] Walter BERNAN (R.S. Meikelham) **active 1845**

Civil engineer. Wrote a comprehensive two-volume study, *On the History and Art of Warming and Ventilating Buildings* (London, 1845). The title page of his classic history continues, *by open fires, hypocausts, German, Dutch, Russian and Swedish stoves, steam, hot water, heated air, heat of animals, and other methods; with Notices of the Progress of Personal and Fireside Comfort and of the Management of Fuel*. Bernan's great work is "Illustrated by Two Hundred and Forty Figures of Apparatus" and is essential reading for anyone interested in the historical development of heating and ventilating.

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



Stove by Boulton & Watt for a museum (from Bernan)

ON THE

HISTORY AND ART

OF

WARMING AND VENTILATING

ROOMS AND BUILDINGS

BY

OPEN FIRES, HYPOCAUSTS, GERMAN, DUTCH, RUSSIAN, AND SWEDISH STOVES, STEAM, HOT WATER, HEATED AIR, HEAT OF ANIMALS, AND OTHER METHODS;

WITH

NOTICES OF THE PROGRESS

OF

PERSONAL AND FIRESIDE COMFORT,

AND OF THE

MANAGEMENT OF FUEL.

ILLUSTRATED BY TWO HUNDRED AND FORTY FIGURES OF APPARATUS.

BY

WALTER BERNAN,

CIVIL ENGINEER.

Meikleham, Robert

VOL. II.

LONDON:

GEORGE BELL, FLEET STREET.

MDCCCXLV.

1845 (Google Books)

PREFACE.

"EVERY man's proper mansion-house and home," says Sir Henry Wotton, "is the theater of his hospitality, the seat of self-fruition, the comfortablest part of his own life, the noblest of his son's inheritance, a kind of private princedome; nay, to the possessors thereof, an epitomie of the whole world." The contrivances to improve the focus or hearth whence warmth and comfort are diffused throughout this interesting dominion, form the main subjects of the following pages.

The inventions, of which the scattered notices are here collected, have in most cases been arranged in the order in which they appeared. A short popular account has been given of each; but it will be sufficient, perhaps, to give a practical person all the working hints he would require to enable him to construct a similar apparatus, or to improve it.

The remarks of the inventor, on the advan-

tages and peculiarities of his project, have in a few cases been given at some length. These are frequently instructive as well as amusing, from our observing how often they have been repeated without acknowledgment by succeeding stove-doctors; how often they have been neglected by the public; and how greatly social comfort would have been promoted had they been regarded. The progress of ventilation, for instance, will show that methods have been practised long ago, and have become obsolete and been forgotten, which have recently been revived, and from their manifest advantage to the community are now rising in public estimation: when the individual exertions which have produced this effect are slackened, they will most likely sink again into the same obscurity from which they have been lately withdrawn. "However paradoxical it may appear," says Rumford, "there is nothing more difficult than to prevail on the public to accept the boon of improvement even in matters which come home to every man's business and bosom," like those which follow.

In a community abounding with inventions of the most recondite character, the inestimable value of apparently trifling improvement, is fami-

liar from experience to all. It is not necessary therefore to bespeak indulgence for the apparent simplicity and obviousness of many of these projects, nor for the terms of respect in which the merit of their originators is mentioned. Fuller puts this in a proper light, when he says,—"I should account nothing little without the help whereof greater matters can either not be attained or not long subsist. Although I confess it is easier to add to an art than first to invent it; yet, because there is a perfection of degrees as well as of kinds, eminent improvers of an art may be allowed for the co-inventors thereof being founders of that accession which they add thereto, for which they deserve to be both regarded and rewarded."

Though much has been done by ingenious men in the art of distributing heat for household uses; it must be confessed, that in one or two instances only have they been able to make a permanent impression or bring their contrivances into that general use as to constitute them "machines of society;" while in the economy of fuel for manufacturing purposes invention has already produced marked benefits; yet however great the saving that may ultimately be effected in furnaces still,

from the nature of things, it must ever be of small importance when compared with that which would arise were better methods of heating and ventilating dwelling-houses generally followed;—of the fifteen-and-a-half millions of tons of coals raised yearly from the mines, not more than three-and-a-half-millions are consumed by steam-engines and in manufacturing operations,—leaving eleven or twelve millions of tons of fuel to be mismanaged in kitchens and sitting-rooms throughout the country. The register-plate was described at the close of the fifteenth century by Alberti, the ancient Florentine architect, and by others who wrote afterwards. Were this simple and cheap smoke-valve introduced into every cottage chimney, it would save the heat of five or six millions of tons of coals that is now annually wasted and thrown away.

The numerous engraved figures that will be found interspersed throughout this compilation, are given as diagrams only, to shorten technical explanation; and the Essays are offered as a contribution towards a chapter of what has yet to be written—a history of personal and fireside comfort.

The *caldarium* of the public baths had a hypocaust formed beneath it, and its walls were so constructed that heated air surrounded the apartment on all its

FIG. IV.

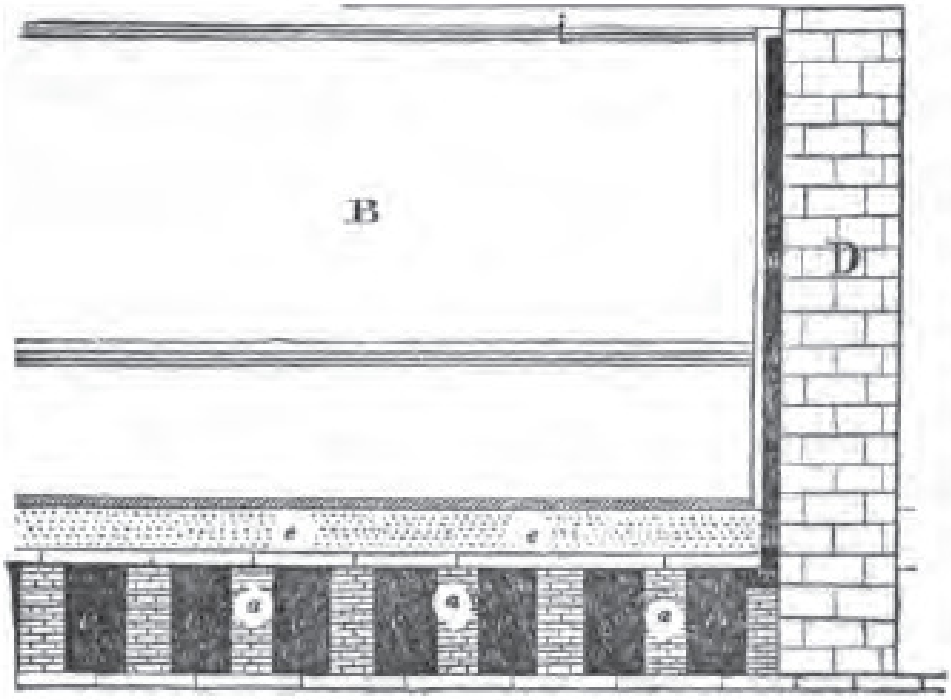
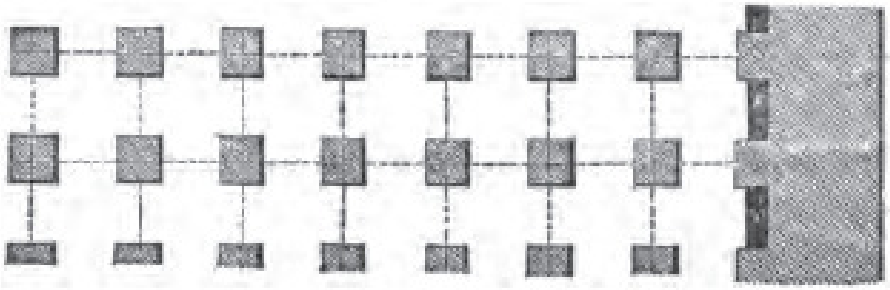
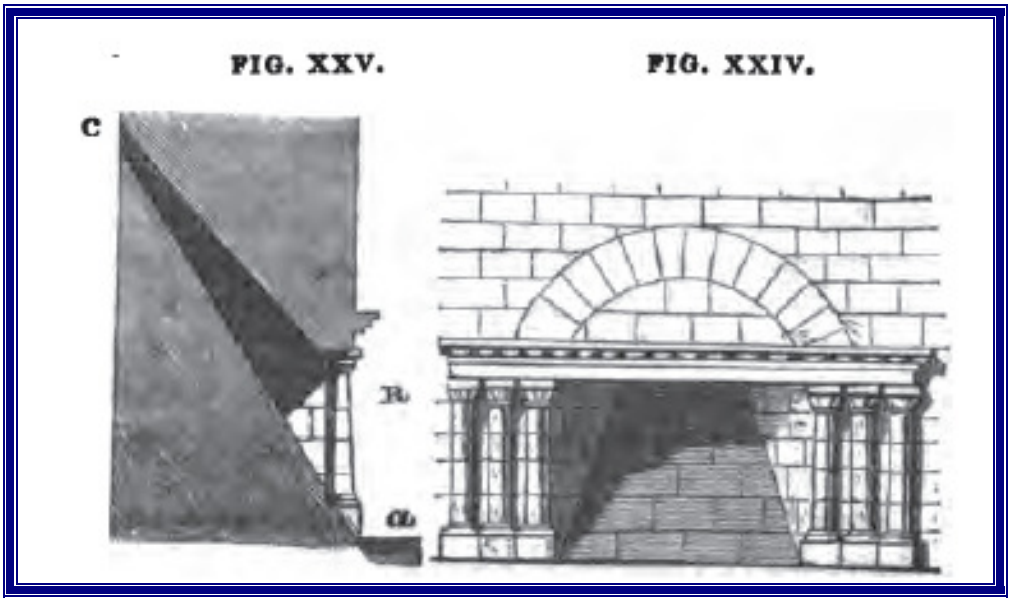


FIG. V.

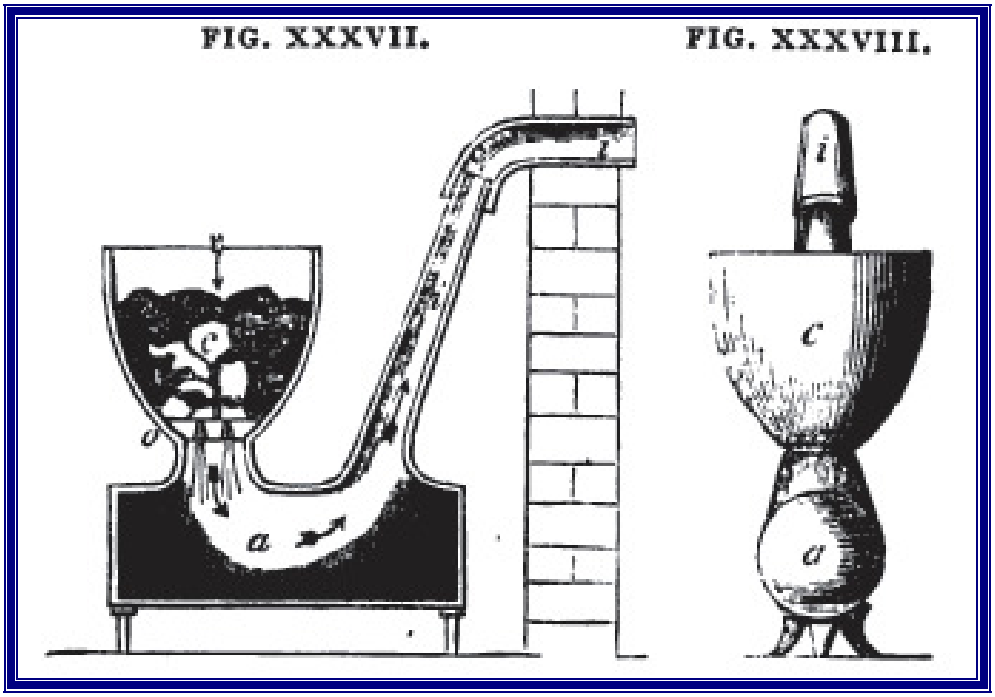


sides. Fig. IV. is a section showing part of the walls and floor of the caldarium, and Fig. V. is a plan of the same portion.*

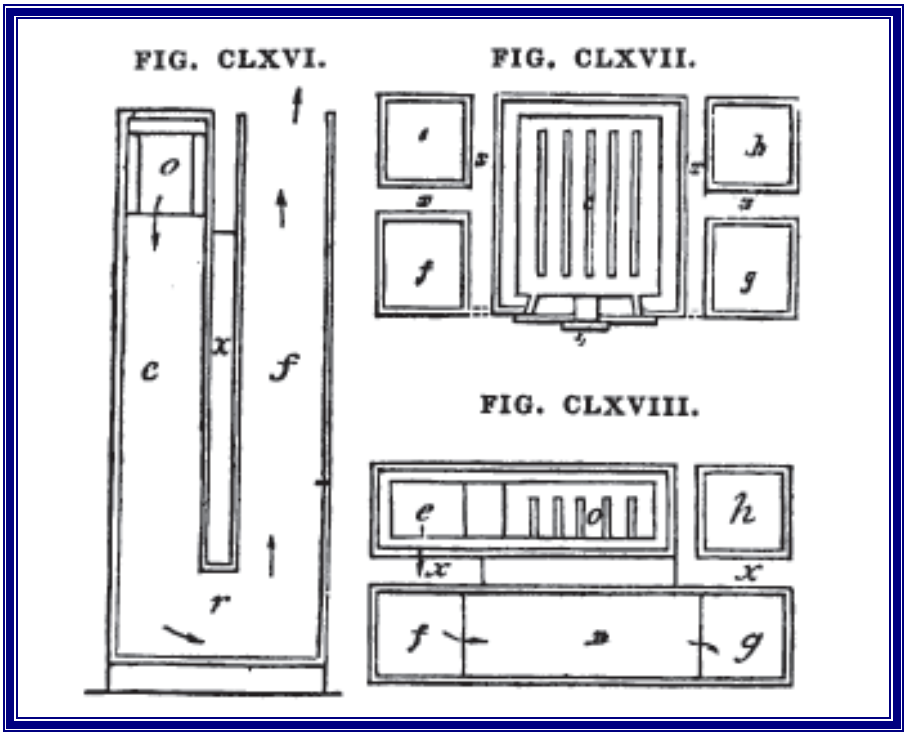
Roman Hypocaust



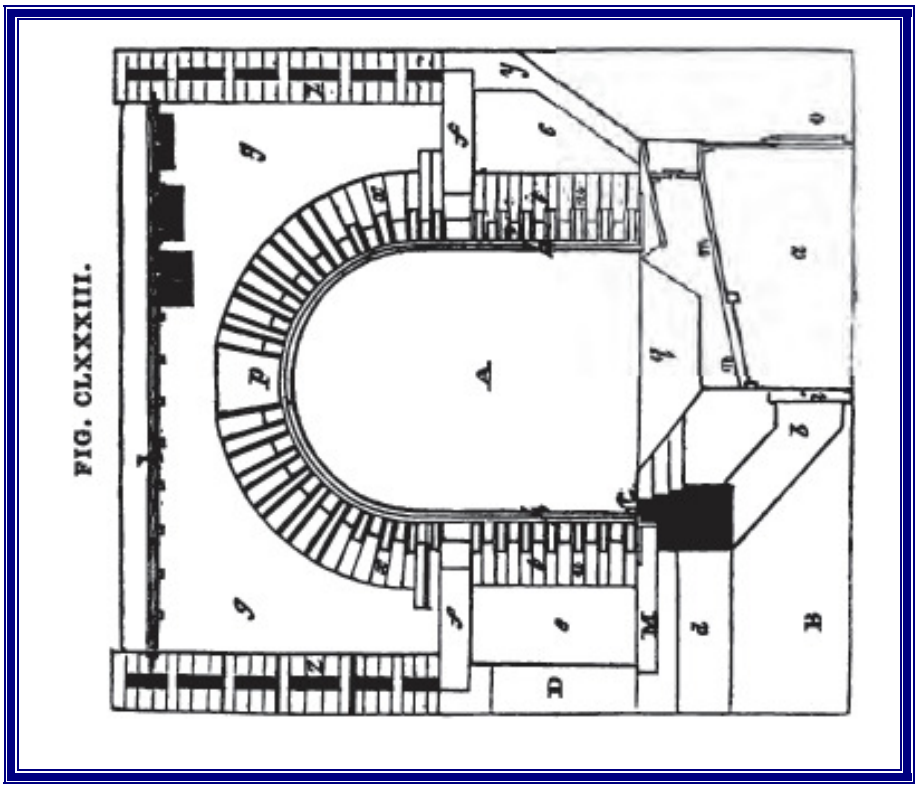
Norman fireplace at Connisborough Castle



Leutmann heating apparatus (German)



Moreau's stove (French)



Boulton & Watt's Cockle stove

GIANFELICE BERTOLINI
1906-1977

Air Conditioning Consulting Engineer

GIANFELICE BERTOLINI **1906 – 1977**

Bertolini was a Doctor of Engineering and Associate Professor at Milan Polytechnic. He is billed by Italian engineers as the first modern consulting engineer in Italy and was highly qualified in his field. He was the initiator of many important engineering concepts and the designer of many outstanding systems. Some examples of his work include the 32 floor Galfa Tower, three major hospitals in Milan, district heating and generation for the Italian District of Comasina in 1961, and the Carlo Felice Theatre in Genoa in 1976. Dr. Bertolini was the founding President of ASHRAE Italiana in 1960 and the President of AICARR for three years. He received the Medal of Honour from AICARR, was a member of the Board of Directors for the Order of Engineers, and the Vice President for the College of Engineers. In later years, he became the founder and editor of two monthly magazines, the AICARR Journal and "Hospital Engineering." Dr. Bertolini, together with the late Paolo Sonino, created the Mostra-Convegno, which is one of the world's leading exhibitions and conferences in the industry. Gianfelice Bertolini was inducted into the ASHRAE Hall of Fame in 1996.

(Edited extract from ASHRAE "Hall of Fame" Citation)

Gruppo Italiano under the leadership of its president Gian Felice Bertolini convened its second exhibition of Heating, Air Conditioning, Refrigeration and Hydrosanitation with its second Air Conditioning Meeting in 1961. There were 85 exhibitors. Today, the show "Mostra Convegno" has grown into one of the most important in Europe.

(From "Proclaiming The Truth," ASHRAE, 1995)

The Galfa Tower, Milan 1968

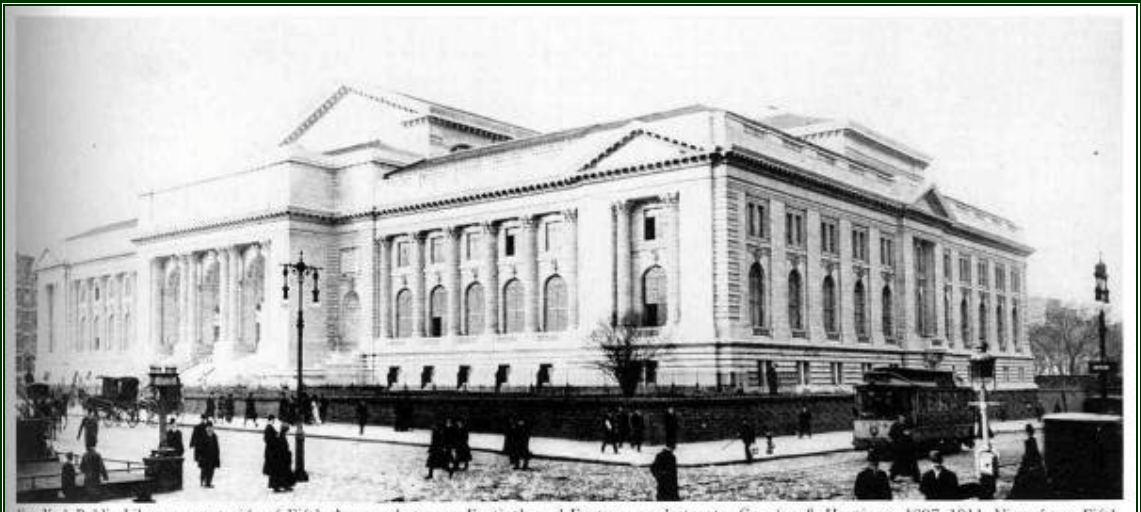
Carlo Felice Theatre, Genoa

Dr JOHN SHAW BILLINGS
1838-1913

Leading American authority on ventilation

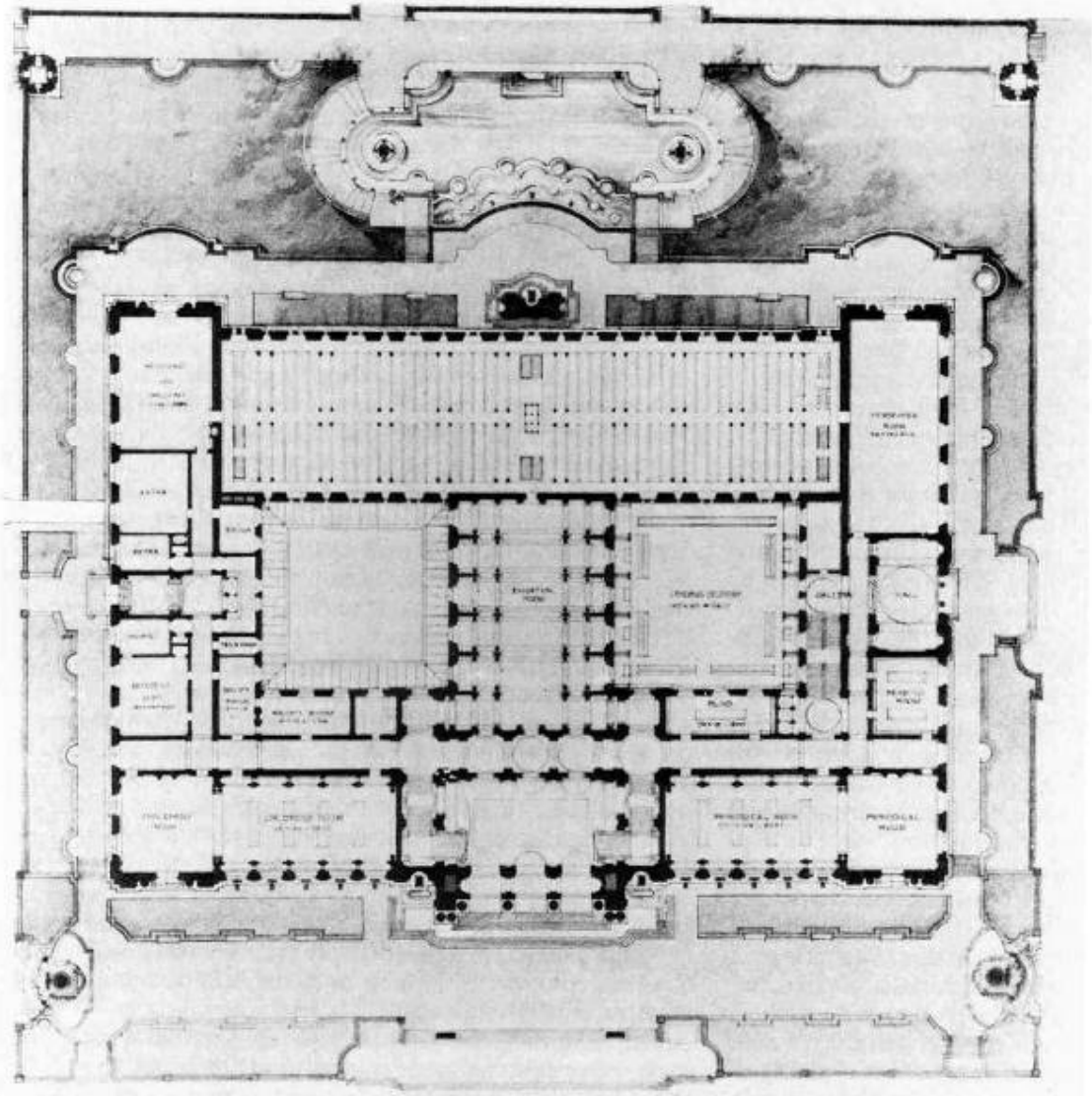
Eminent American surgeon and librarian. Designed and supervised the construction of the New York Public Library (from 1895), which consolidated a number of important collections. Served as its Director until his death. Considered the leading American authority on ventilation, he wrote *The Principles of Heating & Ventilation* (1884). Recommended 60 ft^3/min of ventilating air per person to minimize the spread of disease and 30 ft^3/min as adequate for comfort. As a physician, he was considered ineligible for membership of the ASHVE but was elected the first Honorary Member (1896).

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



New York Public Library, west side of Fifth Avenue between Fortieth and Forty-second streets. Carrère & Hastings, 1897–1911. View from Fifth Avenue. NYHS

New York Public Library, 1897-1911
("New York 1900," Robert A M Stern et al, 1995)



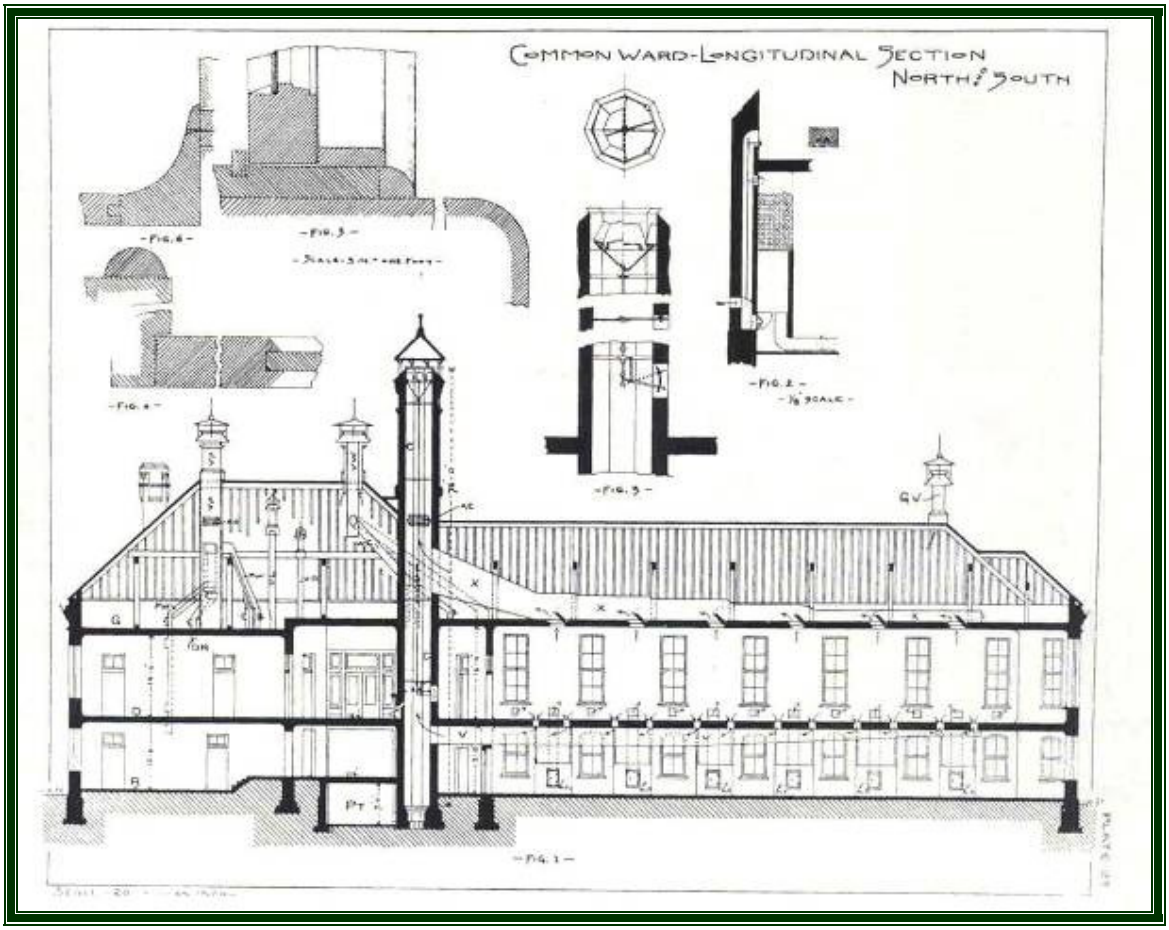
New York Public Library competition entry, west side of Fifth Avenue between Fortieth and Forty-second streets, Carrère & Hastings, 1897. Plan of first floor. CU

New York Public Library, Competition Entry, 1897
("New York 1900," Robert A M Stern et al, 1995)

List of Buildings from "Table of Contents"

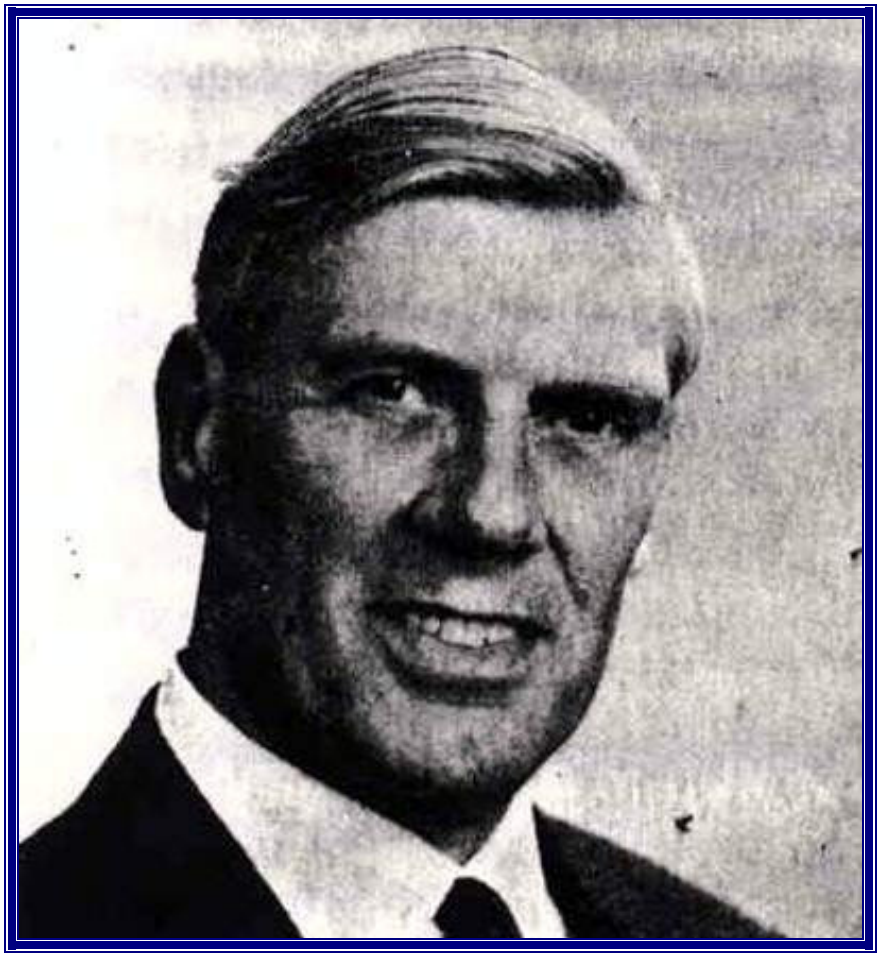
John Hopkins Hospital, Baltimore, 1876-1885
Photograph showing the ventilation towers, part of Billings' ventilation scheme
(From "Architecture in the United States," Dell Upton, 1998)

John Hopkins Hospital
This Common Ward is fitted with "blacksmith beds" featuring
ventilating ducts under each bed



John Hopkins Hospital
Section showing ventilation scheme foe a Common Ward

NEVILLE S BILLINGTON OBE
1916-2009



Scientist, educator, researcher and communicator

A detailed account of his life and works is available elsewhere on this web site in the **Hall of Fame**

Neville S Billington OBE MSc Hon FCIBSE PPIHVE was one of the giants of the Building Services Engineering industry during the 20th century. He was not a practising engineer but a scientist, educator, researcher and communicator. During his career he was a Principal Scientific Officer at the Building Research Station, Head of the National College for Heating, Ventilating, Refrigeration & Fan Engineering, and Director of The Building Services Research and Information Association.

He was perhaps the UK's leading authority on heat transmission in buildings, a subject on which he wrote numerous papers and several textbooks. He developed the theories of unsteady heat flow and intermittent heating and was one of the first authors to write extensively about vapour transfer and condensation in buildings.

Neville was a native of Crewe which may explain his interest in the heating and cooling of passenger trains as demonstrated by his paper "Travelling in Comfort" for the Newcomen Society. He had a passionate interest in the history of the industry. He admired the pioneering work of Thomas Tredgold (1788-1829) and wrote wide-ranging articles from the evolution of lighthouses to showing how the 70 degF isotherm spurred the development of the Ancient Civilisations of Egypt, Arabia and Persia.

He was a familiar face at both national and international conferences and read and spoke French, some German and a smattering of Russian. In 1969 he was awarded the Gold Medal of the French Sciences of Artificial Climate. He helped establish and was later President of the Representatives of European Heating and Ventilating Associations. He served as President of the Institution of Heating & Ventilating Engineers for 1970-71 and was awarded their Gold Medal in 1976.

Neville's was a founding member of the IHVE Archaeology Working Party, later the CIBSE Heritage Group, serving from 1973 until 1991, where he often saw the broader picture or never hesitated to raise a contentious view. In 1982, he co-authored "Building Engineering Services: a Review of its Development," an important record of the history of the industry.

He was a keen member of the Rumford Club (a Dining Club for members of the industry) and served as its Secretary. He was interested in art and was an accomplished painter of landscapes in water colours. In later years his services were recognised by the award of the CIBSE Gold Medal, Honorary Membership of REHVA and the granting of Honorary Fellow of CIBSE.

Thermal Properties
of
Buildings

By

N. S. BILLINGTON

M.Sc., M.I.H.V.E., F.R.S.A.

Head of the National College for Heating, Ventilation, Refrigeration and Fan Engineering, London

Sometime Principal Scientific Officer, Building Research Station, Watford

London

Cleaver-Hume Press Ltd

1952 (CIBSE Heritage Group Collection)

THE INSTITUTION OF HEATING AND VENTILATING ENGINEERS

49 CADOGAN SQUARE, LONDON, S.W.1

A HISTORICAL REVIEW OF THE ART OF HEATING AND VENTILATING

By

NEVILLE S. BILLINGTON, M.Sc., M.I.H.V.E.

Reprinted from

THE JOURNAL OF THE INSTITUTION

Vol. XXIII — OCTOBER, 1955

Mini-bore heating systems

Mr. N. S. Billington, Director of the H.V.R.A. laboratories at Bracknell, Berks.

Although most of H.V.R.A.'s work is concerned with the larger industrial and consumer systems, a development of great interest for the domestic field is a coherent piping system for mini-bore heating installation.

The mini-bore system, which originated in Scandinavia, employs pipes of $\frac{1}{4}$" or even less, and its success depends largely on the arrangement of flow and return connections between riser pipes and appliances. H.V.R.A. have developed a duplex distributing manifold which is integral with the flow and return risers, and from which piping in bores from $\frac{3}{16}$" upwards radiates and provides run-outs to the radiators at each floor level. Normally, a two-pipe system is used, with individual flow and return to single radiators, but a ring main on the one-pipe principle is entirely feasible.

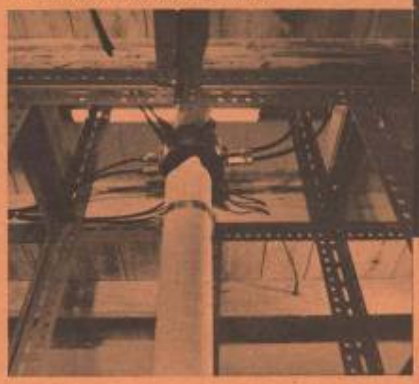
The system is particularly useful for blocks of flats. At the laboratory, a simulated three storey block of flats has been built, in which the distribution pipes are embedded in floor screeds or hidden in hollow skirting boards. Ease of concealing the pipe work is a feature of mini-bore systems.

To determine the suitability of nylon as a substitute for copper or steel mini-bore piping, the prototype system has been working since 1967 at 180°F. and 45 lb./in² pressure, and no signs of deterioration have yet appeared. If nylon can be used successfully there should be very considerable installation economies.

H.V.R.A. are also working on an associated project which will facilitate site work. This is the design of radiator connections which enable the pipework to be completed and the radiator simply "plugged-in", in the same way as connection is made to an electric socket, at the appropriate time.

Development team responsible for work on mini-bore heating systems.

Mini-bore applications, with connections to radiators and hot water cylinder.

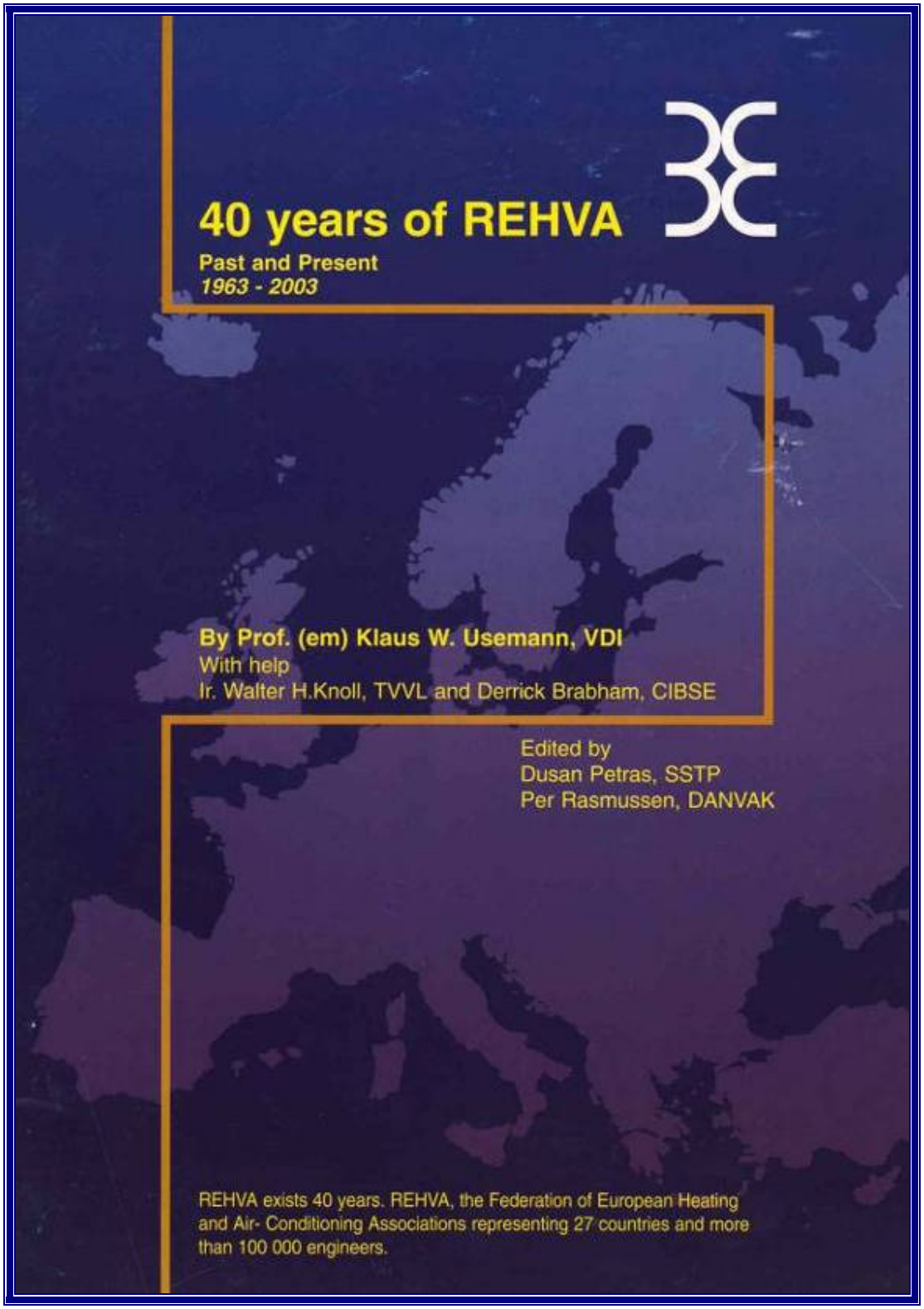


Director HVRA (now BSRIA)

With the Duke of Edinburgh at HVRA

W. R. Cox, J. C. Knight, and N. S. Billington.

1977



(CIBSE Heritage Group Collection)

Presidential Address:

Of shoes and ships and sealing-wax

Neville S. Billington, President 1970-71

Mr. Billington is a native of Crewe, and graduated from Manchester University in 1936 with first class honours in physics. After post graduate study in X-ray crystallography and the award of the degree of M.Sc., he joined the Building Research Station in 1937, working in the Physics Division under A. F. Dufton on problems of heating and ventilation. This was interrupted by war research work, but Mr. Billington returned to BRS in 1942 as Secretary of the Egerton Committee whose report on heating and ventilation of dwellings was most influential and laid the foundation for subsequent official recommendations.

From 1944 he recommenced research on heating and ventilating being particularly concerned with air filtration, heat flow through walls and roofs, and condensation.

In 1950 he became head of the National College for Heating, Ventilating, Refrigeration and Fan Engineering and inaugurated research there. During his term of office at the College plans for the existing new building were prepared, and the present scope of the work of the College owes much to Mr. Billington.

He encouraged the formation of the Heating and Ventilating Research Association and became its first full time Director in 1958, a position which he still holds.

He has been much concerned with the international relations of the industry, helping in 1951 to inaugurate an informal study group of research workers in heating and ventilating and being instrumental in the formation of REHVA—Representatives of European Heating and Ventilating Associations, a now flourishing informal association producing, in collaboration with HVRA, THERMAL ABSTRACTS, and doing much other work in the documentation field. Mr. Billington also represents the United Kingdom at meetings of certain committees of the International Standards Organization.

He joined the Institution in 1948 and was elected a member of Council in 1956. He has served on several of the Institution's committees, as well as Government and other committees on matters relating to services engineering.

His many technical papers in the IHVE Journal and elsewhere and his two books on the thermal properties of buildings have made an important contribution to the understanding of heat flow in buildings. His work has been honoured in the United Kingdom by his investiture as an Officer of the Order of the British Empire in 1966, and in France by the award to him of the Gold Medal of the Sciences of Artificial Climate in 1969.

The title I have chosen is not, I hope, as irrelevant as it might appear. It gives me the opportunity to range over the field, to 'talk of many things'; and moreover, sealing wax is a time-honoured research tool.

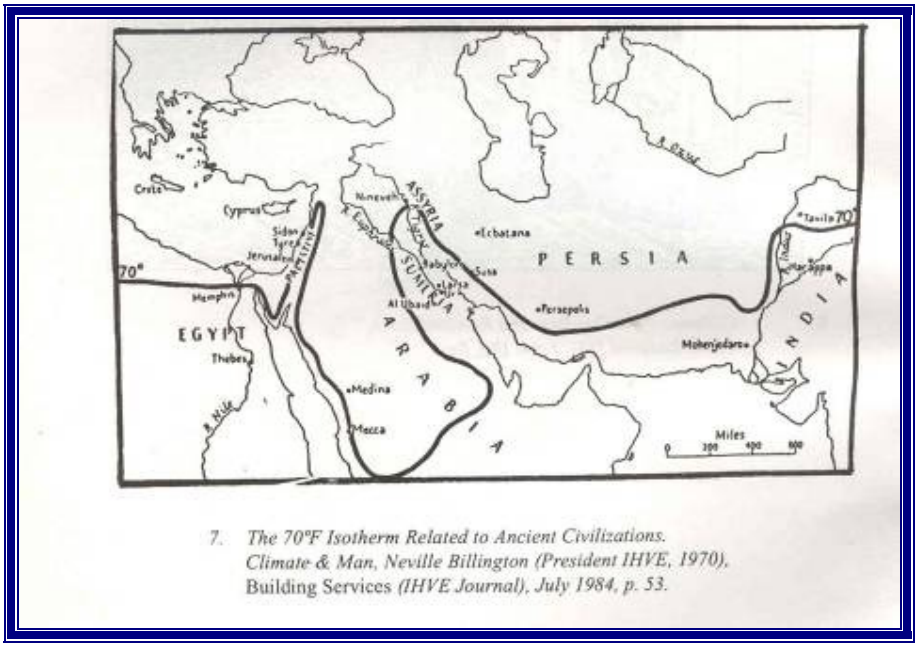
Recent addresses by incoming Presidents have been concerned with the internal affairs of the Institution. I want to examine the place of the Institution in the affairs of the industry and of the nation. These external relations may be summarized in the word 'responsibility'. The responsibilities of the Institution are of two kinds. There is the duty to ensure the development of the industry in readiness for anticipated future needs; and there is the duty of any professional body to speak on matters of public concern.

We may first examine these responsibilities in some detail, and then seek ways of fulfilling them. From this will emerge courses of action which I believe the Institution should follow. It will be seen, I hope, that the actions I shall suggest will serve to promote several of the aims set by successive Presidents—a respected professional body whose opinion and advice is not only noted but actively sought; a means of securing greater participation by all members everywhere; the transformation of our technology from a Cinderella to an exciting and challenging new discipline which will attract the best brains in the country.

We must not forget—and there seems little danger of this—that we are an engineering body. Our primary concern is the engineering of a satisfactory environment in which people may live, work or enjoy their leisure, or for the growth of crops or the rearing of animals. But it is a negation of our responsibility as engineers if we content ourselves with the design and provision of the engineering services without enquiring for ourselves as to the client's real needs. If our business is to create adequate warmth, we should at least understand the human requirements both physiological and psychological. If we are not satisfied that we know enough to do our job, we cannot, dare not, shrug off the duty of finding out more for ourselves.

A shoemaker, I believe, has the duty to examine the anatomical consequences of any design he makes and sells. Doctors need to be aware of the side effects of the drugs they employ. The environmental engineer has the responsibility of knowing the consequences of his designs and advice. The lighting expert should consider not only visual acuity and glare, but also the effects of his equipment on the thermal environment. The psychological disturbance from the unthinking use of light has been illustrated in fiction by Nevil Shute, and in reality by the outbursts in discotheques where

Pinning the Past President's Medal on E G Brooks 1970



7. *The 70°F Isotherm Related to Ancient Civilizations.*
Climate & Man, Neville Billington (President IHVE, 1970),
Building Services *(IHVE Journal), July 1984, p. 53.*

Appendix III

Chairmen

1947	B. C. Oldham	1970	S. J. Shelton
1948	O. Stott	1971	A. W. Evans
1949	C. N. V. Benwell	1972	A. H. Woodley
1950	J. F. L. Grocott	1973	A. J. Roberts
1951	J. W. Cooling	1974	R. A. Smith
1952	D. G. Sayers	1975	B. W. R. Hickmott
1953	C. Hall	1976	G. F. M. Murray
1954	L. A. Johnson	1977	H. F. J. Fenton
1955	H. D. Mills	1978	R. A. Dick
1956	W. Harding	1979	J. W. H. Cook
1957	T. Bedford	1980	A. F. C. Sherratt
1958	A. E. Merrin	1981	A. G. Foster
1959	G. E. Clifford	1982	B. Overall
1960	J. W. S. Cove	1983	C. Izzard
1961	D. B. Pinkney	1984	B. Michelmore
1962	C. Troup	1985	H. Nicoll
1963	L. G. W. Gosden	1986	R. H. Cowell
1964	E. F. Cowell	1987	R. Neeve
1965	N. S. Billington	1988	G. Baker
1966	F. M. H. Taylor	1989	E. S. King
1967	C. J. Atkins	1990	M. Austin
1968	E. W. Burman	1991	B. Franklin
1969	R. J. Totman		

Secretaries

W. J. Chambers	1947
G. E. Clifford	1947-1959
L. A. Johnson	1959-1964
E. Ower	1965-1978
A. G. Foster	1978-1980
N. S. Billington	1980-1989
R. J. Oughton	1989-

Assistant Secretaries

A. G. Foster	1977-1978
E. Ower	1978-1979
N. S. Billington	1979-1980

Treasurers

J. Backer	1971-1979
D. W. Wood	1979-

OUR INDUSTRY'S PAST

Neville Billington surveys 200 years of heating and ventilating.

Although heating, in one form or another, has existed since the earliest times, heating and ventilating *engineering* is not much more than 200 years old. Indeed, 1980 can be regarded as a bi-centenary. Lighting technology and sanitary engineering began at about the same time. The emergence of these technologies was dependent on large-scale mining, which required ventilating and led to the fan, on the development of steam power by Newcomen and Savory, on Fourier's study of heat flow, on the researches of Chézy and Bernoulli on fluid flow, and on Crawford's and Lavoisier's work on physiology and metabolism. Our Members of Parliament then, as now, clamoured for good conditions to work in, and the Houses of Parliament were always a convenient building in which to experiment and try out new ideas. The industrial revolution, with its multiplication of factories and increasing urbanisation, gave rise both to the need for environmental control and to immense social problems.

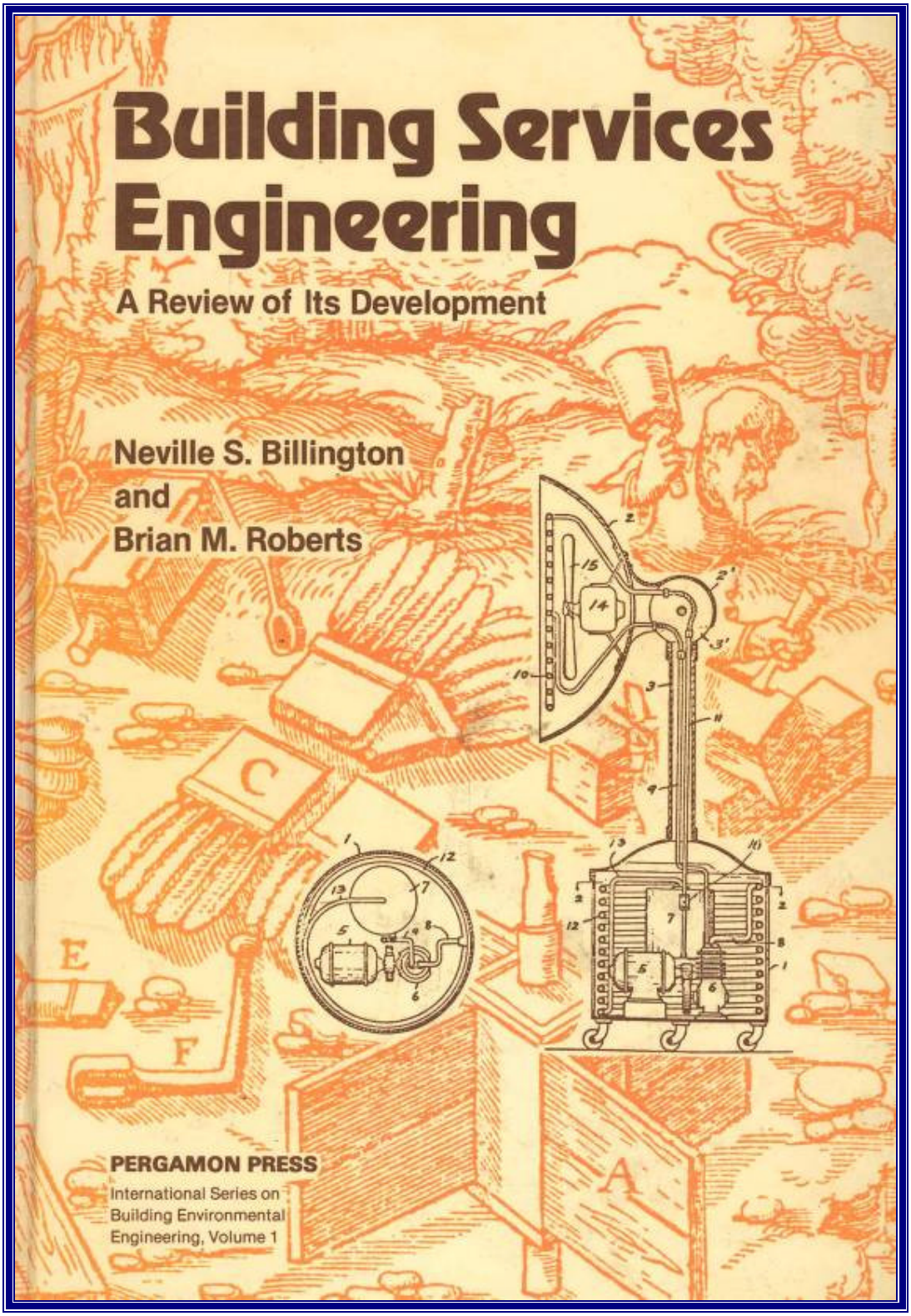
The growth of towns was a highly significant factor. The emerging municipalities, stemming from the Municipal Reform Act of 1835, needed public buildings for administrative and other purposes. In 1837 there were only five cities (outside London) in England and Wales with populations greater than 100 000; by 1891 there were 23 and they contained one third of the population. Many were obsessed with civic pride and strove to outdo each other and use the most advanced technology available. Bradford built a concert hall (St George's) in 1851; one of its principal features was the massive gas-lighting installation. Leeds, not to be outdone by its neighbour, embarked on its Town Hall in 1853. The architect, Cuthbert Brodick, was forced to accept a clause in his contract by which he would receive no remuneration if the cost exceeded his estimate. The project included a tower, added at a late stage of the design, and the cost of this was indeed greater than contemplated. Fortunately, the deficit was made good by an unexpected surplus on the warming and ventilating work. The Education Act of 1870 established a national school system. The numerous new schools all needed heating and ventilation. The industry (if it could yet be so called) was presented with countless opportunities in the growing number of public buildings of all kinds being erected in the second half of the 19th century.

The first half of our period is probably the most important era. Almost all the conceptual advances and the principal discoveries took place before 1880. Capt Cook had suggested steam heating in 1745; M Bonnemain hot water heating in 1777. The period saw the development of steam, hot water and warm air heating, not as a continuous evolution from the fire and the stove, but as discrete and distinct innovations. The multi-tubular boiler was in-

This French free-standing stove dating from around 1815 was sold at a Sotheby auction.

SERVICES HERITAGE

Old services equipment can be valuable and beautiful. It can also teach us much. This feature is more than a chance to revel in past glories and ignore the future: we must apply what we learn to ensure the industry's future health.



1982 (CIBSE Heritage Group Collection)

Travelling in Comfort

by

NEVILLE S. BILLINGTON, O.B.E., M.Sc., F.C.I.B.S.

Read at the Science Museum, London, on 13 November 1985

G. Kichenside, writing in *150 Years of Railway Carriages*, states:[26]

> Railway history is bound up with social history, by reflecting changing trends—carriage provision being forced on unwilling managements by public opinion or by legislation. It took nearly 70 years for railways to accept that passengers on long-distance journeys might need to use a lavatory, eat or even feel warm. Many railways resisted such developments because the provision of toilets, dining cars, of heating and of good lighting all added to the weight of the train.

HEATING OF TRAINS

In *Locomotive Railway Carriage and Wagon Review* one reads:[6]

> Although the desirability of heating railway carriages was recognised from the beginning, it was long before any effective system was devised; indeed it may be said that a thoroughly efficient method is a comparatively recent development. For many years, heating was commonly performed by means of portable containers filled with hot water, which were pushed, with much clatter and disturbance, into the carriage and were supposed to impart some warmth to its interior, but more especially to the feet of the semi-frozen passenger. As a means of producing chilblains, it would be impossible to improve on this primitive contrivance, but as it lacked every desirable feature, and was besides most troublesome and uneconomical, requiring quite elaborate plant for charging, heating, handling and maintenance, it gradually gave way on progressive railways to more scientific and satisfactory arrangements.
>
> It is remarkable that the use of steam from the locomotive, though this might be supposed to be the obvious solution of the problem and was in fact tentatively used in Germany as far back as 1865, was neglected in favour of stoves, either alone or in conjunction with hot air circulation or thermo-syphonic water apparatus in bewildering variety. The most complete account of such systems, to the writer's knowledge, is to be found in Moreau's monumental *'Traité des chemins de fer'*, vol. **IV**, Sec. 590–713 (written about 1897).

The hot-water tin was introduced to Britain by the Great Northern Railway in 1852, though it had been used previously in France and North America. The tins were hired by passengers and placed in a floor recess. Findlay, describing the working of the LNWR,[19] states:

> . . . from November 1 to March 31, every compartment (of all classes) was provided with at least two foot-warmers. The ordinary warmer is an oblong tin filled with water and sealed: it is then placed in a boiler until the water is hot. The present soda-acetate warmer is now (1899) in use on all main lines of the LNWR—a comparatively recent introduction. The heat is retained nearly three times as long as the water tins, viz, about 8 hours. The heaters are charged thus—7 quarts of liquid soda-acetate are placed in each, 7 oz of water added, and 2 cast-iron balls 2 in. dia. and weighing 20 oz are placed inside. The entire heater is warmed to boiling point and then sealed.

Ellis[7] says the soda-acetate warmer was introduced by the LNWR in Webb's time and it was later adopted by other railways. The foot-warmer went out of general use about 1901 though it was still available until c1914 and later on slip coaches owing to the difficulty of arranging steam hose-couplings for these.[3] A Midland Railway working timetable of June 1911 gives detailed instruction as to the supply and distribution of foot-warmers to the public. Similar soda-acetate heaters were brought into use in Australia in 1891 and not finally phased out until 1976. They may still be found on certain sections of South African Railways.[9]

Fuel-burning stoves do not seem to have been used in passenger vehicles in Britain, though they were employed in Europe at least until the end of the 19th century. In Britian, however, stoves were regularly used in guard's brake vans where there were no passenger seats; they remained in use well into BR days.[25] Gautier (*Voyage en Russie*, 1873) commented that the foot-warmer would soon freeze

Industry mourns the death of building services icon

by Peter Jackman

The father figure of the building services industry, Neville Billington, has died.

Billington, who died on 17 May aged 93, was once described as 'the all-time industry icon', such was his unsurpassed contribution to the advancement of heating, ventilation and air-conditioning technology in buildings.

Billington's career started in 1937 when he joined the government-funded Building Research Station, where his work on the heating and ventilation of dwellings became the basis of approved UK application. In 1950 Billington was appointed head of the National College for Heating, Ventilating, Refrigeration and Fan Engineering in South London. During his nine years of headship it grew in size and scope, making a crucial impact on the technical status of the industry.

In 1958 Billington became the first full-time director of the Heating and Ventilating Research Council – later the Heating and Ventilating Research Association (HVRA). He remained director until retiring in 1975, when the association became the Building Services Research and Information Association (BSRIA). Billington also led impressive technological developments that helped the growth of the building services industry as a whole. Under his leadership, the association became a world-renowned source and depository of technical information.

Neville Billington died in May

He was technically brilliant and able to research, write and lecture on a wide range of subjects – including radiator testing, thermal insulation, productivity in artificial environments, air quality, ventilation of dwellings, air-conditioning of hospital wards, and energy efficiency.

While Billington's priority was the welfare and development of the research association, he played an active part in the Institution of Heating and Ventilating Engineers (IHVE, now CIBSE) making a huge contribution to its technical publications and guides. He became its president in 1970, and was awarded the institution's Gold Medal in 1976.

Another of Billington's pioneering involvements was setting up the Federation of European HVAC Associations (REHVA). He represented IHVE on its management board and was president from 1976 to 1978. He was also actively involved in the British Standards Institution, International Council for Building Research, International Institute of Refrigeration, the Committee of Directors of Research Associations, the Rumford Club and more.

Billington's outstanding contribution to the building services industry was recognised with an OBE in 1966. In France in 1969 he also received the gold medal of the Sciences des Climats Artificiel.

Neville Billington was a true gentleman, a professional of the highest order, who played a colossal part in the technical development of our industry and in inspiring others who work in it.

(CIBSE Journal, July 2009)