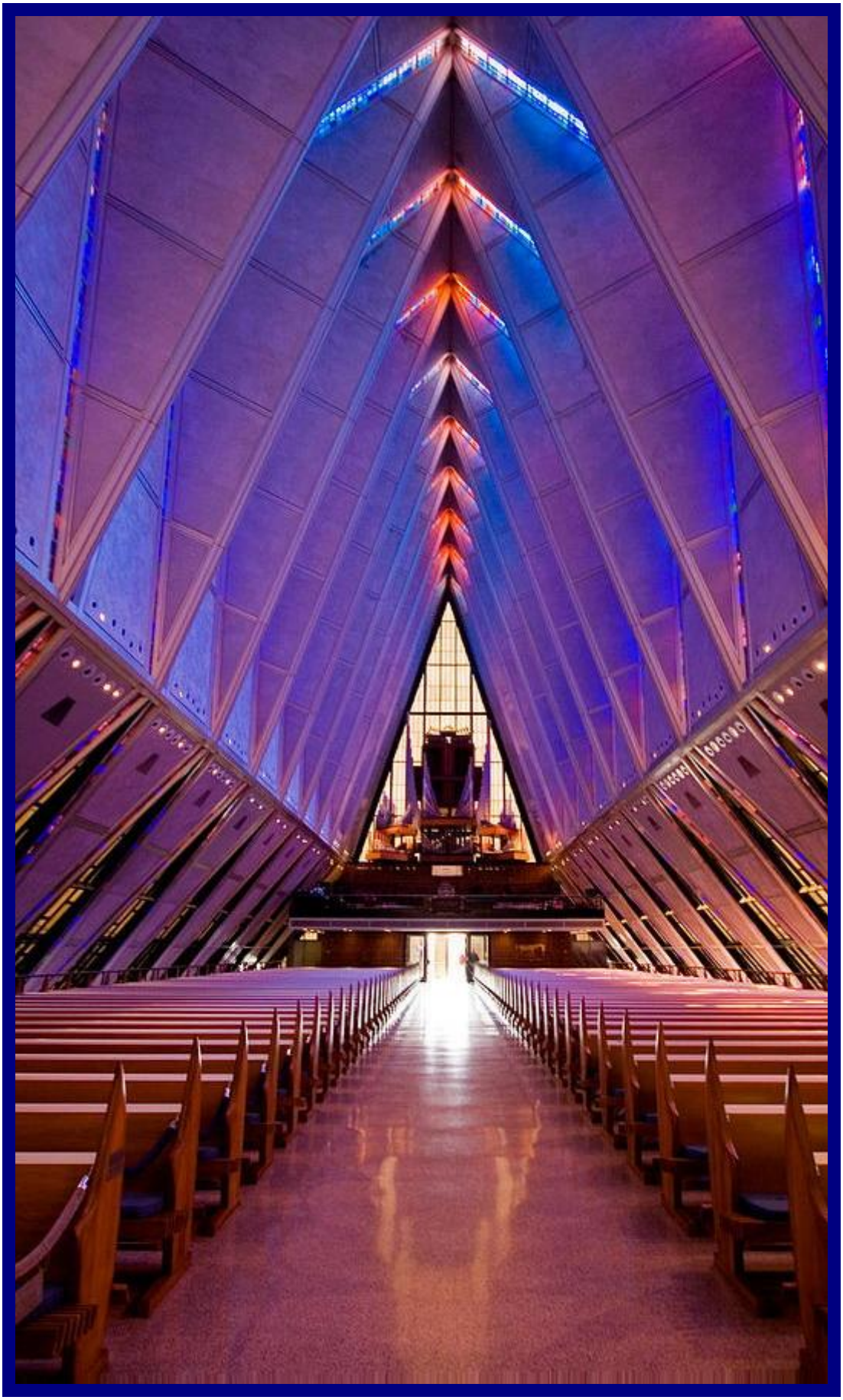
Founders' Day Parade at the United States Air Force Academy Chapel, Colorado Springs.

HISTORIC BUILDINGS

THAT I HAVE NEVER VISITED AND WISH I HAD WITH SOME EXAMPLES OF AIR CONDITIONING

BRIAN ROBERTS

USAF CHAPEL COLORADO SPRINGS 1962



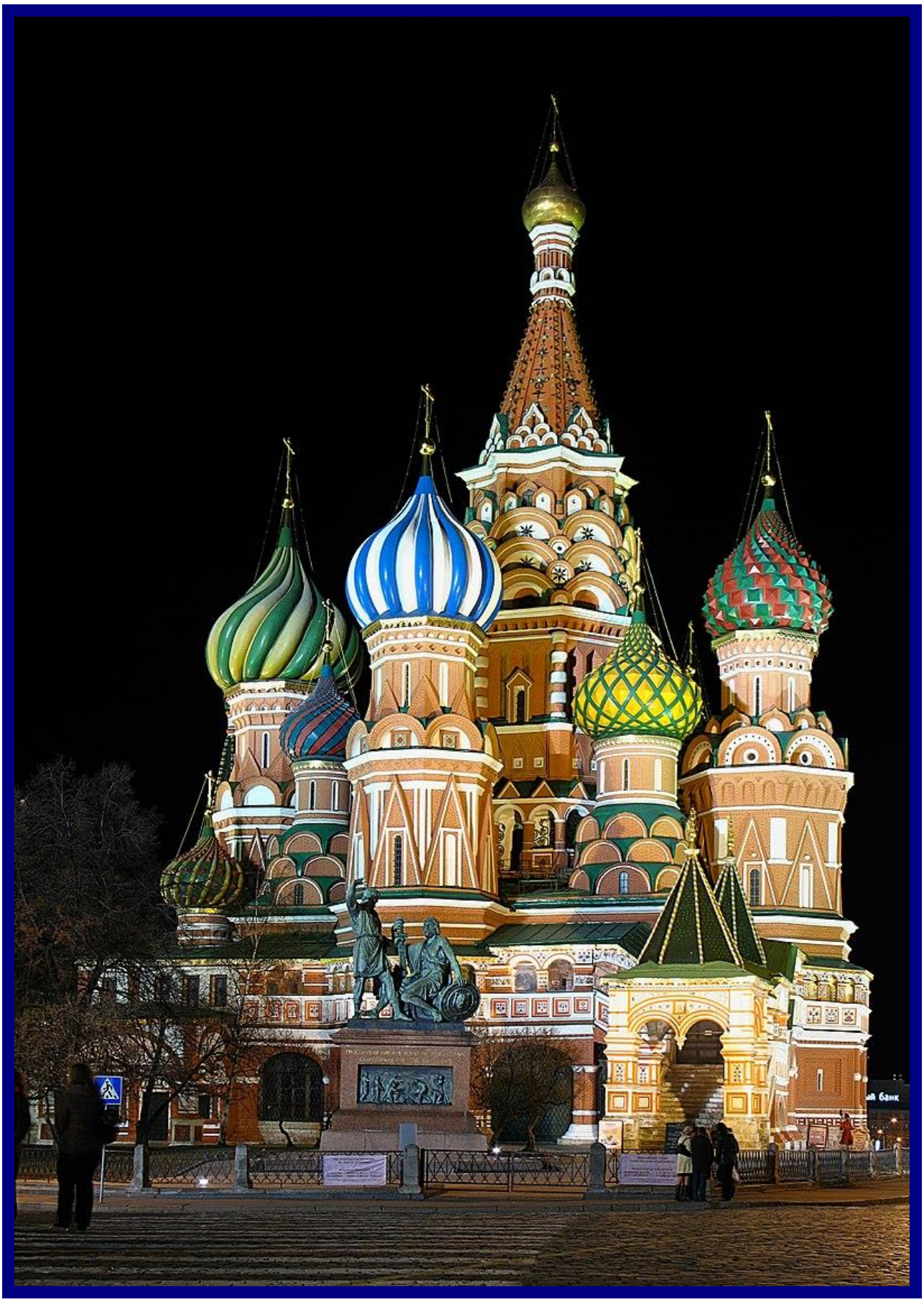
USAF CHAPEL COLORADO SPRINGS 1962

Since 1973, members of the Heritage Group have researched, visited and recorded details of the history and engineering services of many types of building, not only in the UK, but in Europe, Asia and the USA. The Group now includes representatives in Australia, France, Italy, the Netherlands and the USA. As a result, we have written and printed a small number of booklets with photographs, drawings and information on buildings of interest, with notes on their engineering services: systems, equipment, manufacturers and so on.

Although the writer has visited many of these countries, and looked at a variety of building services engineering, there are hundreds that I have never managed to see. Therefore, now long retired, this booklet is completely different. As the title states it looks at "Buildings that I have never visited and wish I had."

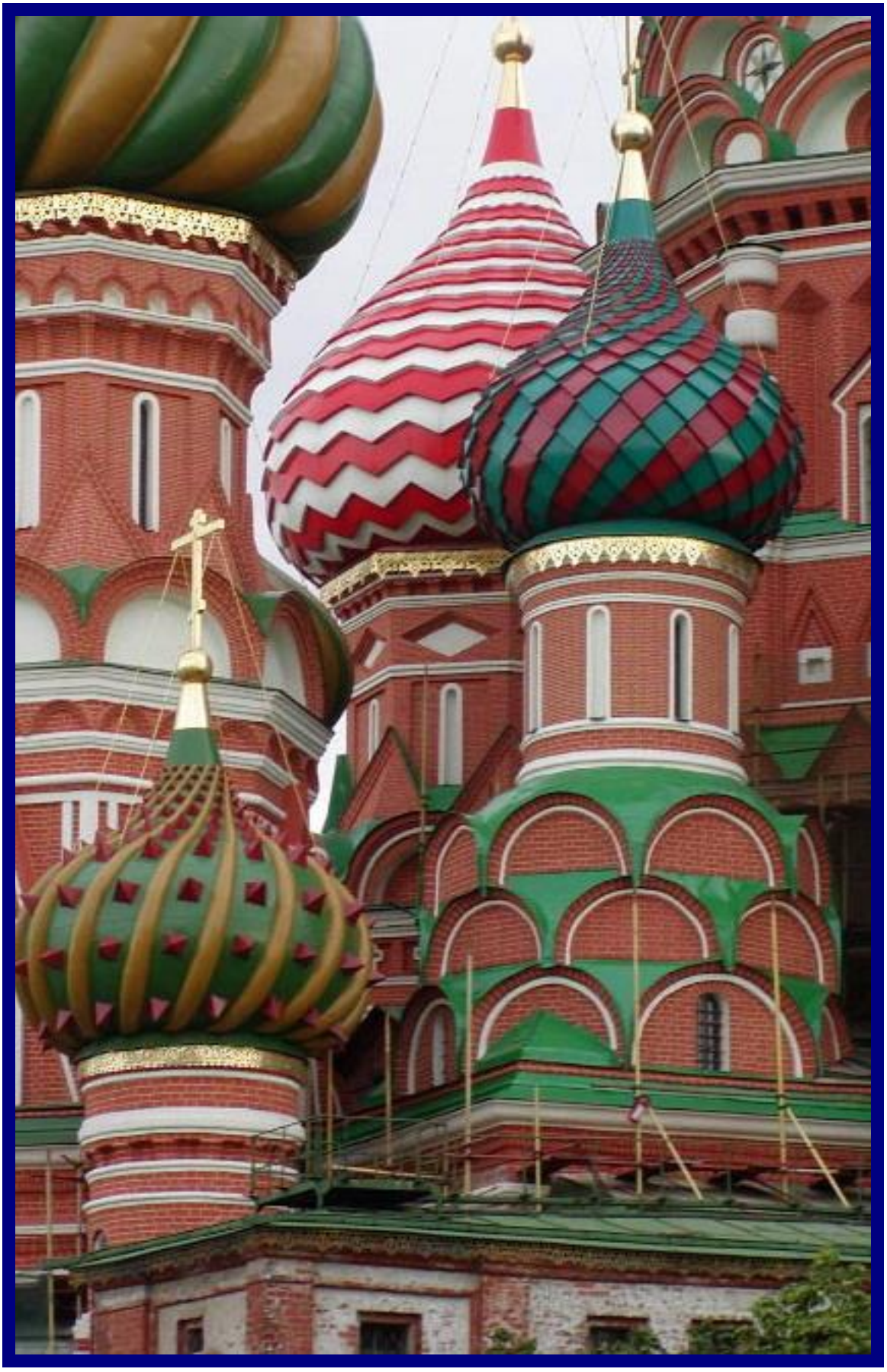
CONTENTS: FEATURED BUILDINGS

SAINT BASILS CATHEDRAL MOSCOW 1561



Cathedral of Vasily the Blessed in Red Square.

SAINT BASILS CATHEDRAL MOSCOW 1561



The Cathedral has nine domes, each for a different church.

SAINT BASILS CATHEDRAL MOSCOW 1561

The Cathedral was built by order of Ivan the Terrible.

SAINT BASILS CATHEDRAL MOSCOW 1561

A State Historical Museum since 1928, now has occasional church services.

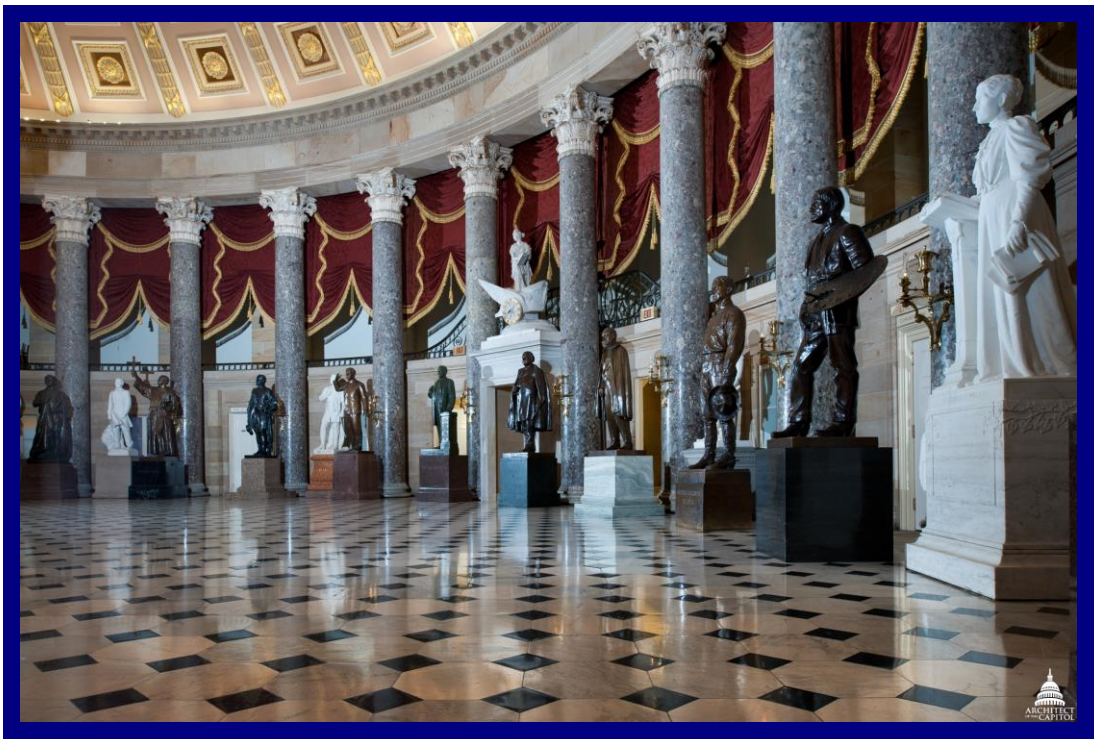
US CAPITOL WASHINGTON D.C. 1800-1962

The "spectacular" iron dome was designed and built 1855-63.

The dome and the "huge extensions" were by Architect Thomas U. Walter and Army Engineer (later General) Montgomery C. Meigs.

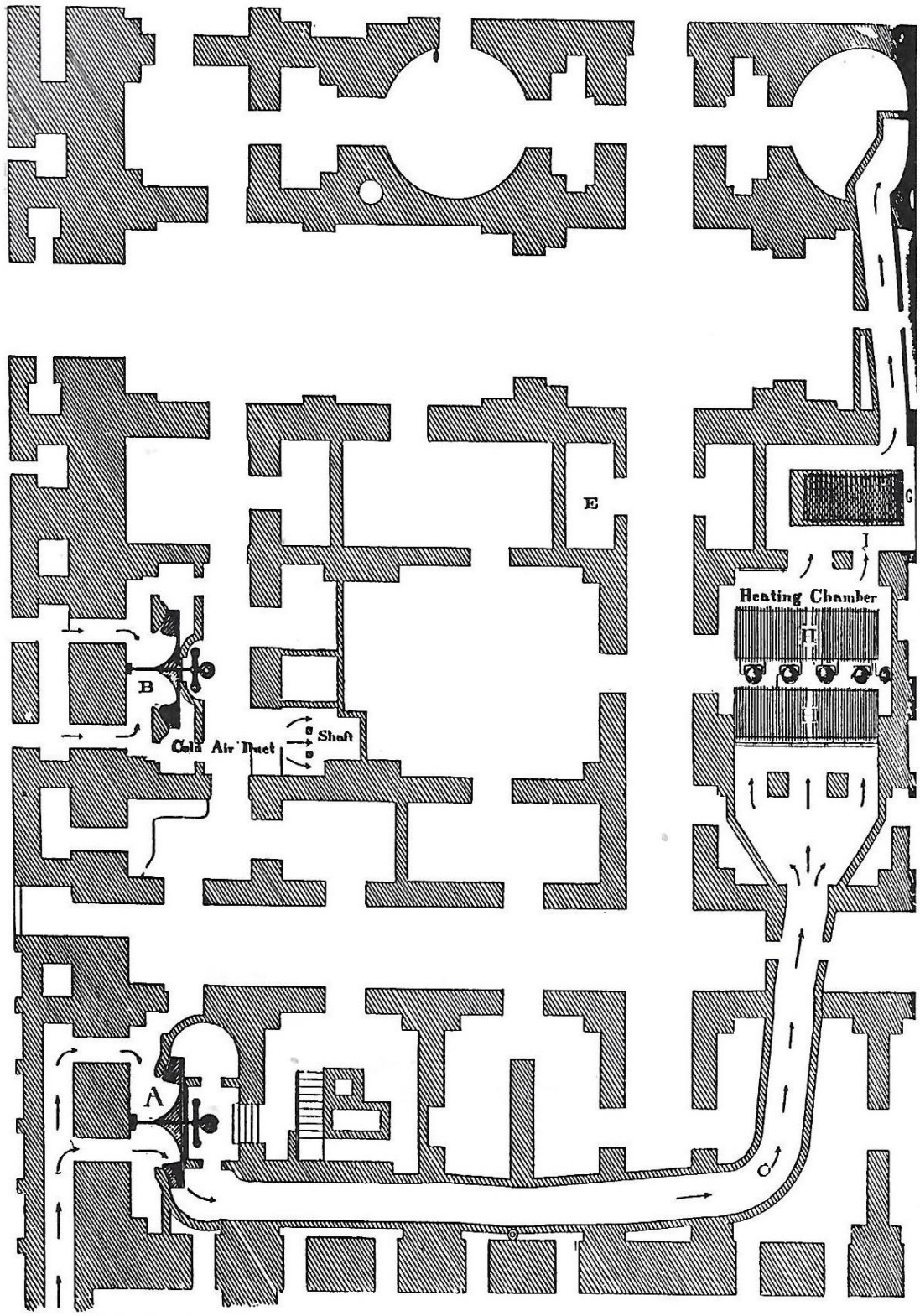
US CAPITOL WASHINGTON D.C. 1800-1962

A public tour in progress, viewing the huge paintings in the Rotunda under the Dome.



The Statutory Hall commemorates famous Americans including Dr John Gorrie (1802-55), of Florida who patented a refrigeration Ice Machine (USP No. 8080: May 6, 1851), and is said to have devised an air conditioning (?) system in 1833 for treating fever stricken sailors in hospital by blowing air over buckets of imported natural ice.

US CAPITOL WASHINGTON D.C. 1800-1962

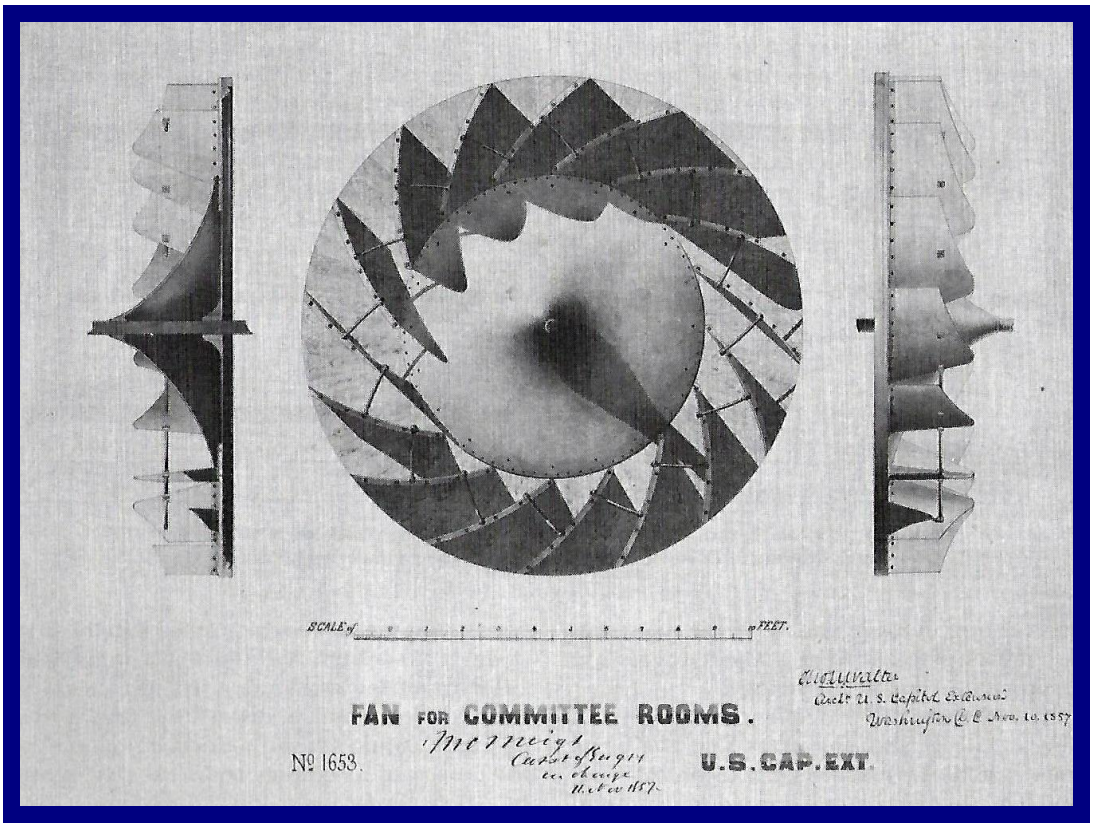


PLAN SHOWING AIR DUCTS, ETC., IN CONNECTION WITH HEATING APPARATUS, SOUTH WING, U. S. CAPITOL.

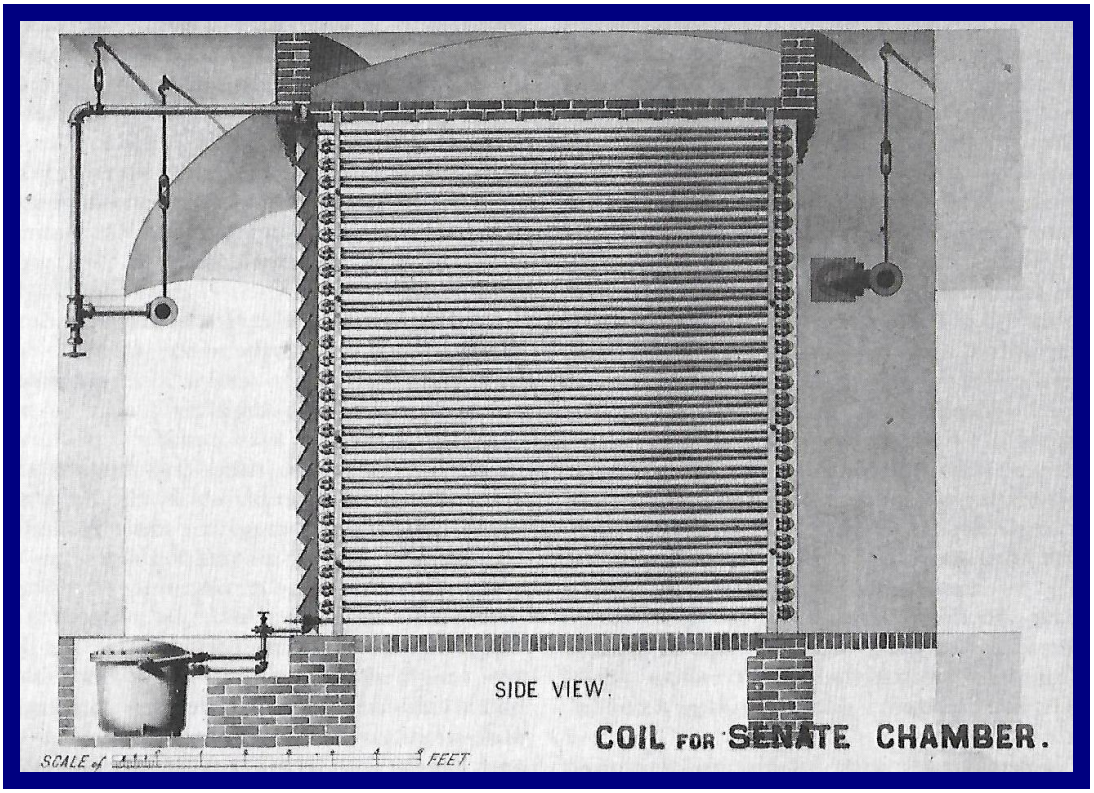
A—Main Fan for Hall.
B—Small Fan for Committee Rooms.
G—Evaporator and Mixing Chamber.
H—Heating Coils.

Heating and Ventilating System of 1881.

US CAPITOL WASHINGTON D.C. 1800-1962



Large centrifugal fan rotor of 1857, 14 ft diameter (no casing), cast-iron central cone, wooden vanes, fastened with metal angles and straps, designed by Robert Briggs.



Steam heating coil 1858, straight wrought-iron pipe, assembled with return bends. Large pot-type steam trap (at lower left).

US CAPITOL WASHINGTON D.C. 1800-1962

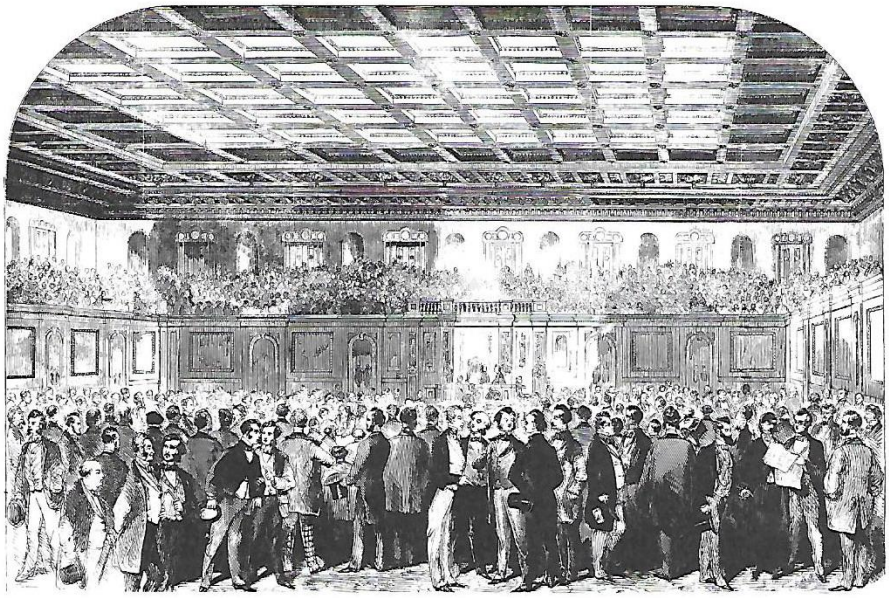


Fig. 12.26 The House of Representatives meeting in its new hall December 3, 1860. *Harper's Weekly* for December 15, 1860.

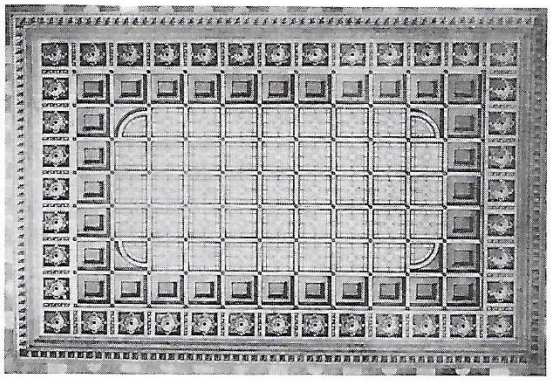


Fig. 12.27 Plan of ceiling dated March 28, 1856. The visible ceiling was of cast iron elements cast in New York and stained glass from Philadelphia. Drawing dated March 28, 1856.

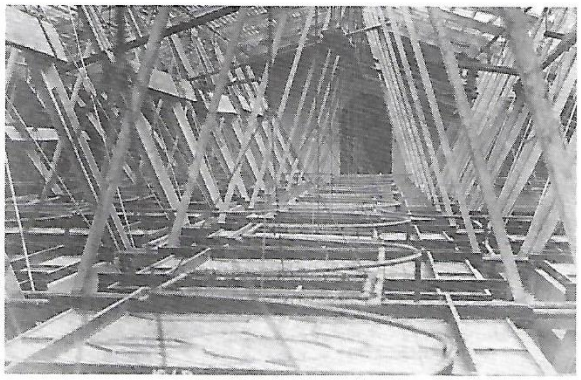


Fig. 12.28 Photograph dated Feb. 2, 1858. Between the glass ceiling and the skylight was a blazing inferno. Suspended gas pipes were arranged in curves with "the jets near enough together to light each other from a small perpetual burner."

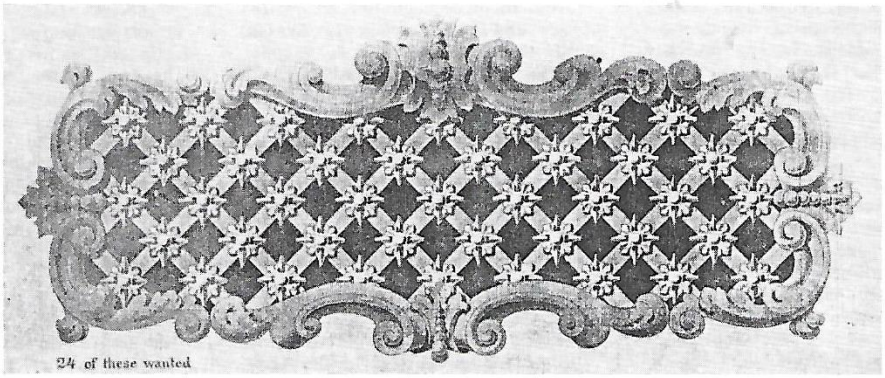


Fig. 12.29 Ornamental design for ventilating register.

Arrangements for heating, ventilating and lighting by Montgomery Meigs from 1853. Initially described as "perfect, successful and admirable" but within ten years or so there was a call to return to opening windows and natural light.

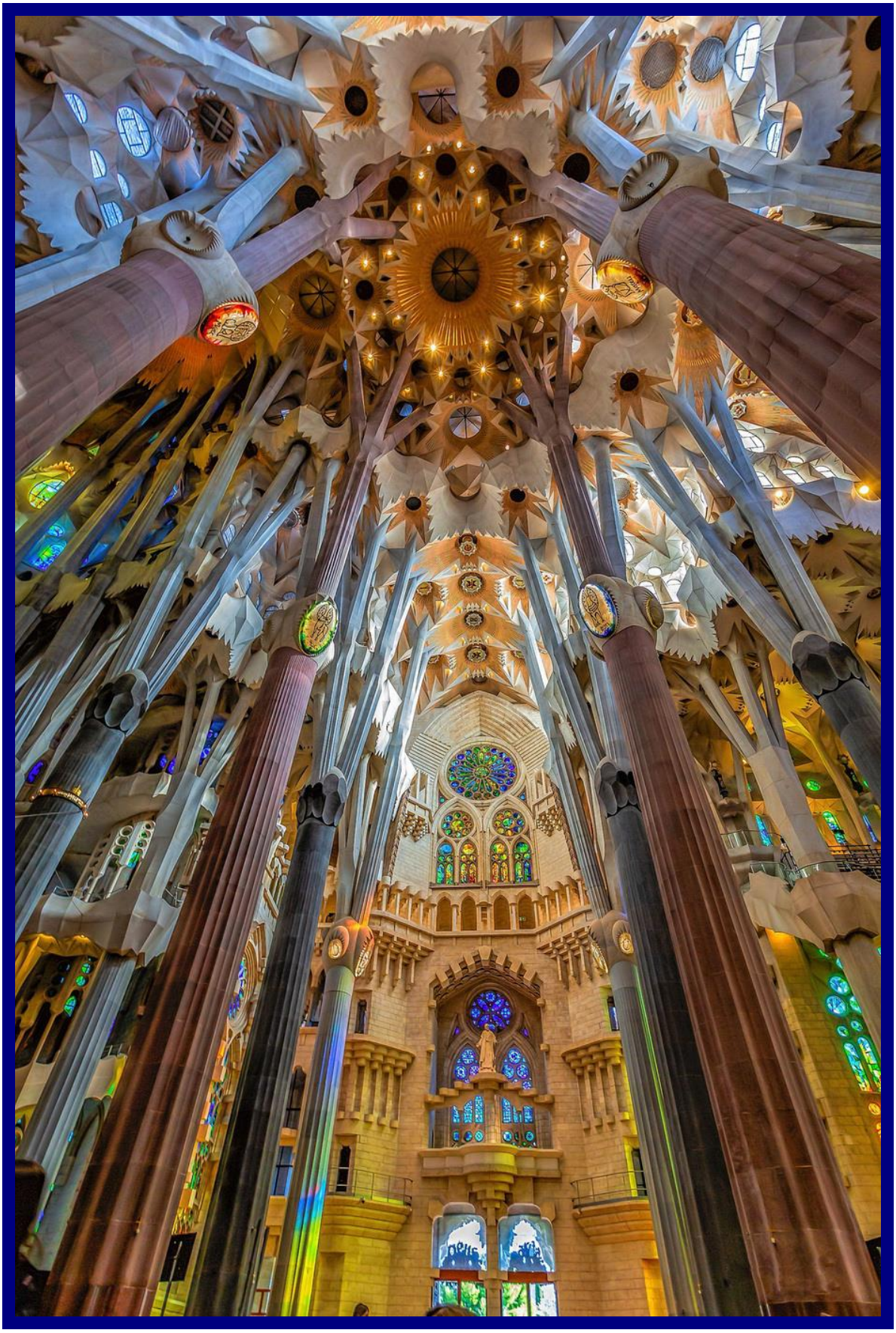
US CAPITOL WASHINGTON D.C. 1800-1962

The Dome of the US Capitol topped with the Statue of Freedom.

SAGRADA FAMILIA BARCELONA 1882

Unfinished Roman Catholic Minor Basilica. Antoni Gaudi architect 1883 until his death 1926. Capacity 9000 persons, Length 300 ft, Width 200 ft, Height 560 ft (planned, making it world's tallest church). Consecrated in 2010. Designed to have 18 spires, each symbolising a figure in the New Testament, but only10 spires built to date.

SAGRADA FAMILIA BARCELONA 1882

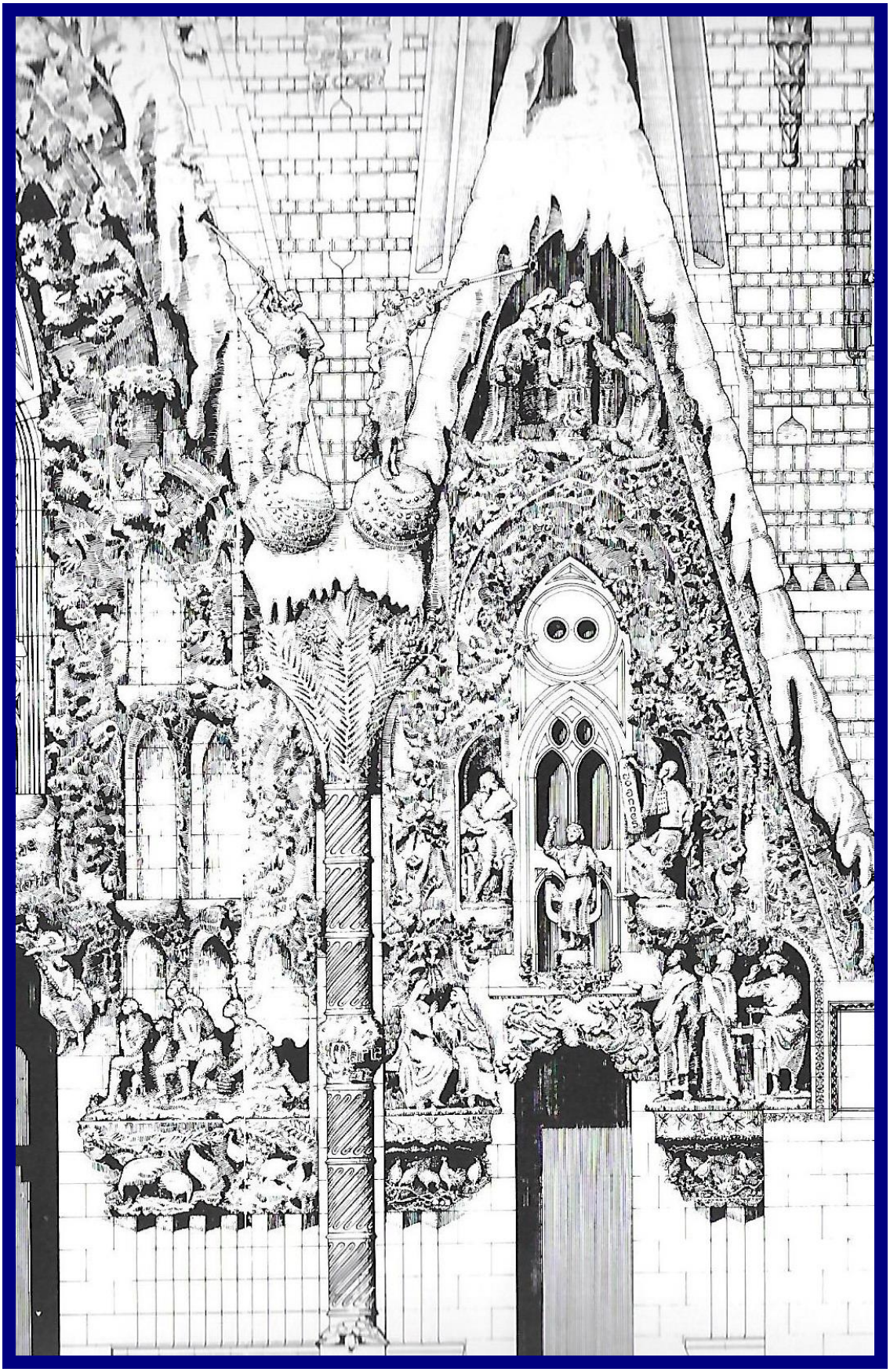


Gaudi's architectural and engineering style combines Gothic and Art Nouveau forms.

SAGRADA FAMILIA BARCELONA 1882

Biblical stories told in stone and light.

SAGRADA FAMILIA BARCELONA 1882



Detail and carvings on the Nativity Facade, Charity portal.

NEW YORK STOCK EXCHANGE 1903

Photograph of 1904 from the Library of Congress.
All fourteen storeys were mechanically ventilated (200,000 cu.ft/min).
A detailed description is available in Arnold, pp.14-18.

NEW YORK STOCK EXCHANGE 1903

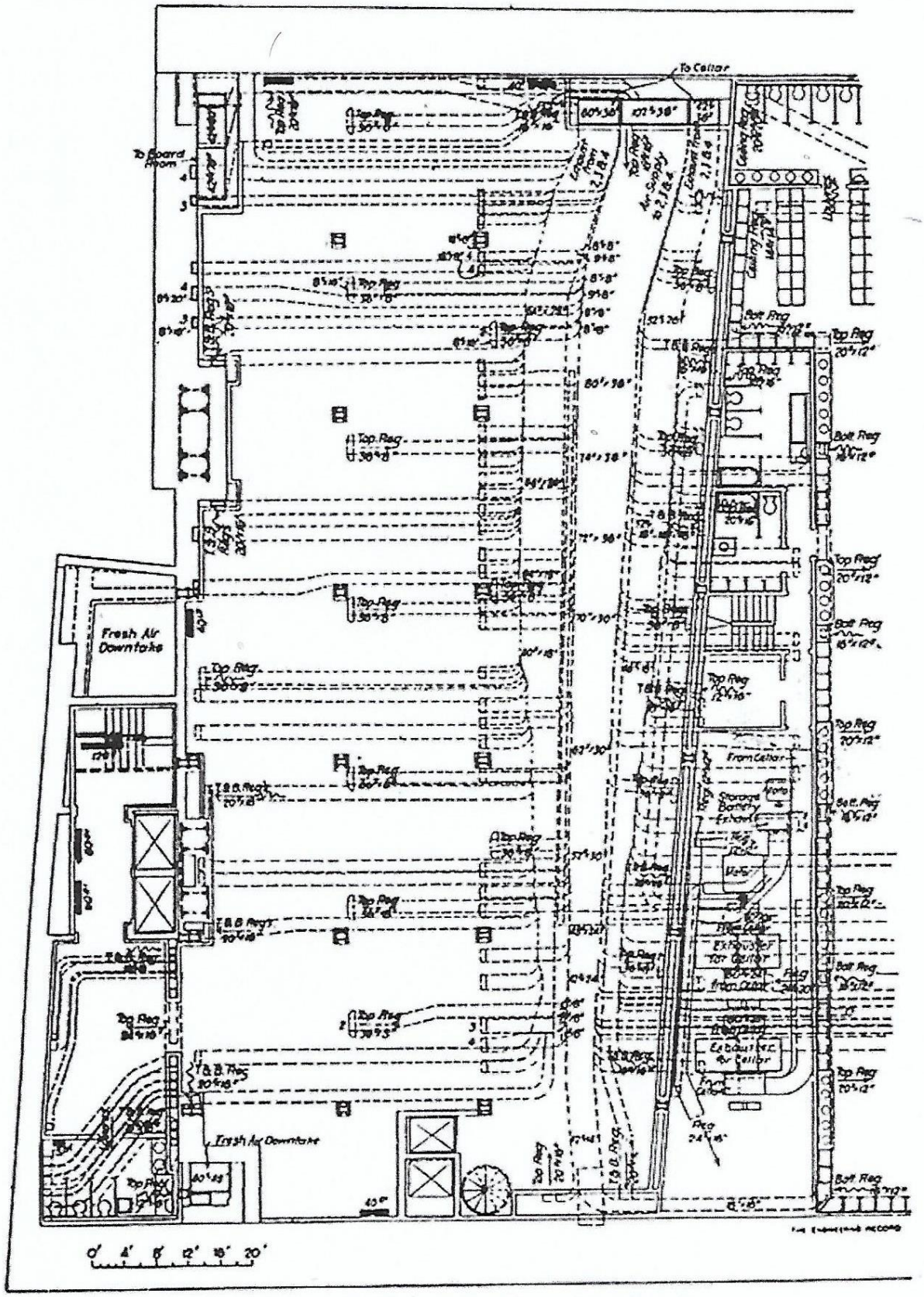
BIG COOLING PLANT IN STOCK EXCHANGE.

Three 150 Ton Machines Will Try to Keep the Brokers' Tempers Even—This Practically Marks the Opening of a New Era in Refrigeration.

INTERIOR OF THE BOARD ROOM OF THE NEW YORK STOCK EXCHANGE.

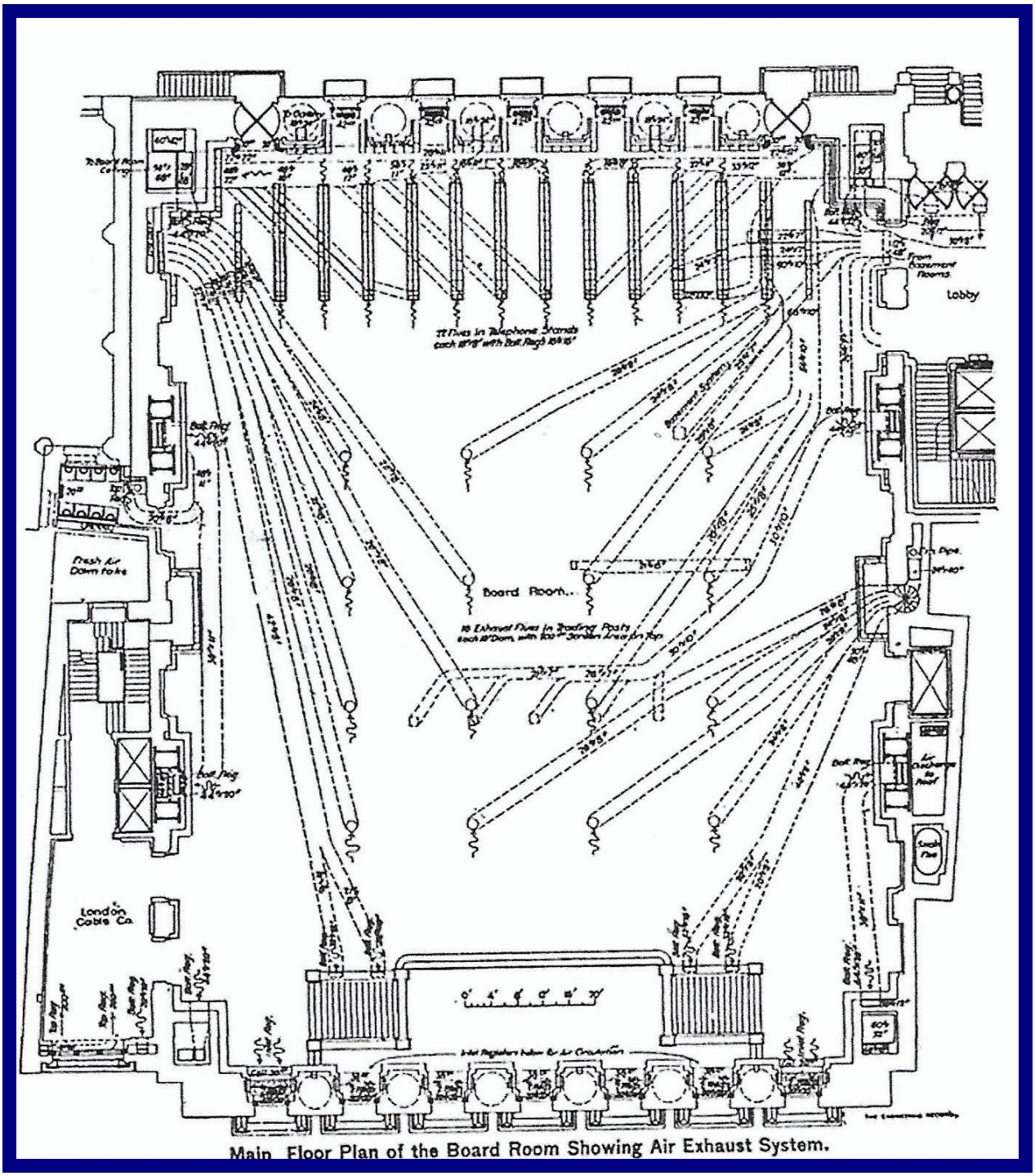
Air conditioning designed by Alfred Wolff and refrigeration by Henry Torrance Jr. Four high-pressure steam boilers fed three steam engine-driven DC generators of 750 kW. Exhaust steam, supplemented by live steam, provided winter heating using a mix of direct and indirect radiation. Summer cooling came from three 150 TR (450 TR total) steam-powered absorption brine chillers utilising a brine storage tank. Board Room 40,000 cu.ft/min plenum supply, 300 TR.

NEW YORK STOCK EXCHANGE 1903



Ducts over Ceiling of Sub-Basement No. 2.

NEW YORK STOCK EXCHANGE 1903



Main Floor Plan of the Board Room Showing Air Exhaust System.

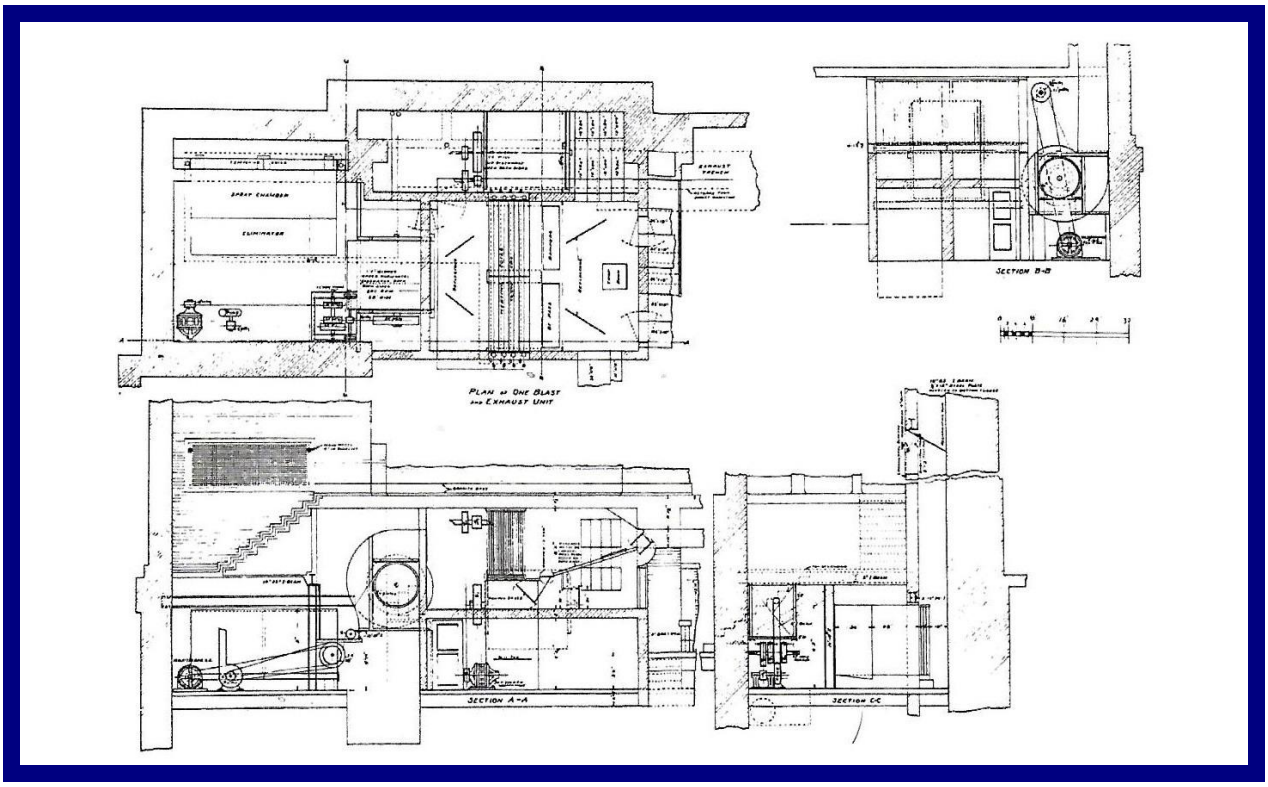
See also a description of the design and systems in Donaldson & Nagengast, pp.274-6.

LARKIN BUILDING BUFFALO 1904

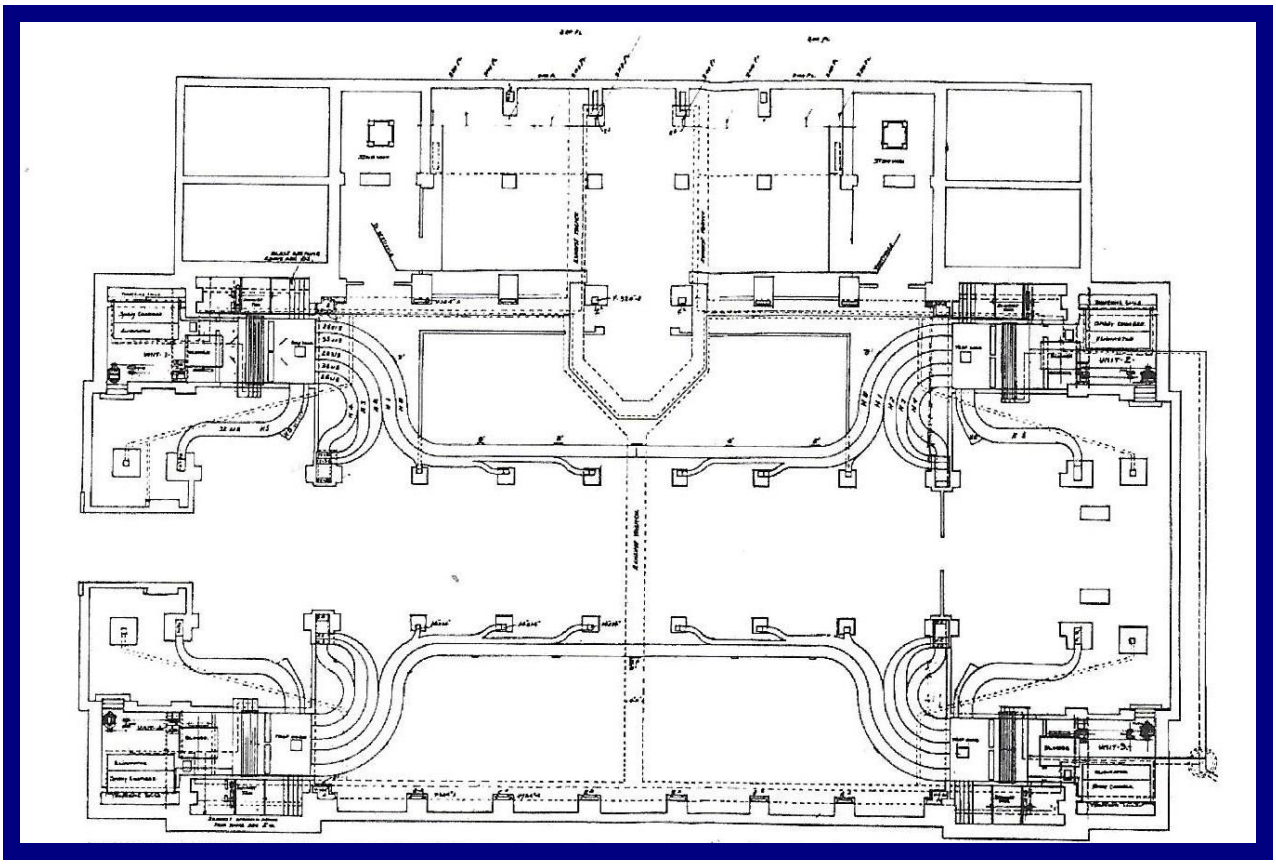
Modern computerised visualisation of the exterior of the building which no longer exists being demolished in 1950. The architect was Frank Lloyd Wright.

Modern computerised visualisation of the interior of the building.
Claimed to be one of the first buildings to be air conditioned it has been reported that refrigeration was not installed until 1909, this carried out by Kroeschell Brothers of Chicago, but even this date is in dispute.

LARKIN BUILDING BUFFALO 1904



One of the four "Air Purifying and Cooling Devices."

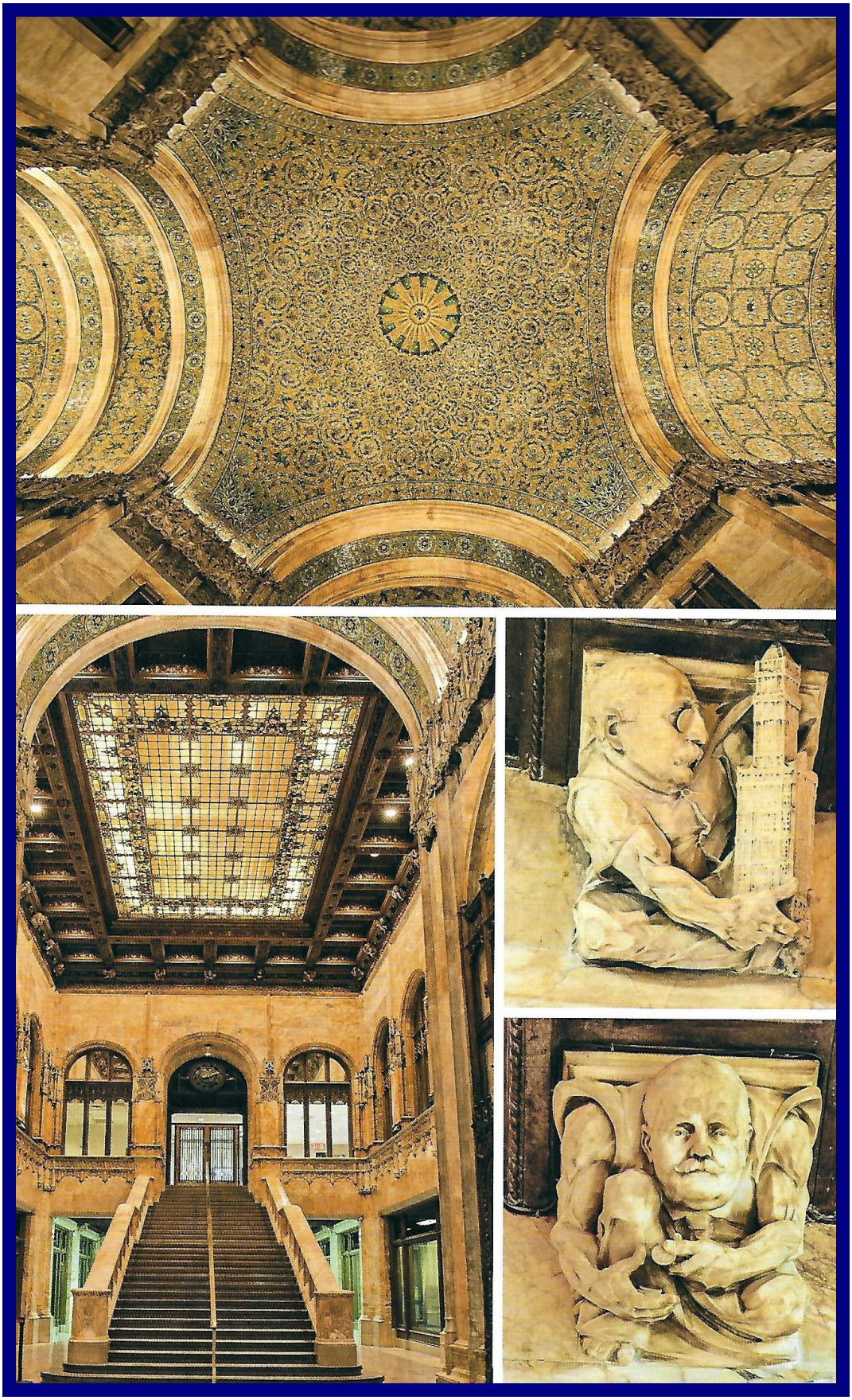


Layout of the plant and air distribution ductwork in the basement.

WOOLWORTH BUILDING NEW YORK 1913

792 ft, 57 floors, tallest building in world 1913-30. Provided with Dunham Vacuum Steam Heating. Mechanical Ventilation up to 46th floor. Details of HVAC, Plumbing, Elevators, Electric Power & Lighting, Central Vacuum Cleaning, are in "Master Builders," pp.45-69.

WOOLWORTH BUILDING NEW YORK 1913

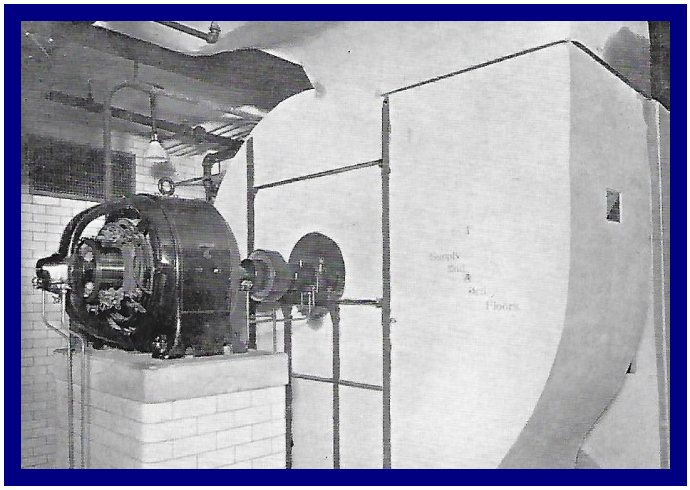


Elaborate lobby ceiling mosaics and staircase with caricatured sculptures of Cass Gilbert, Architect (top) and Frank Woolworth, Owner (bottom).

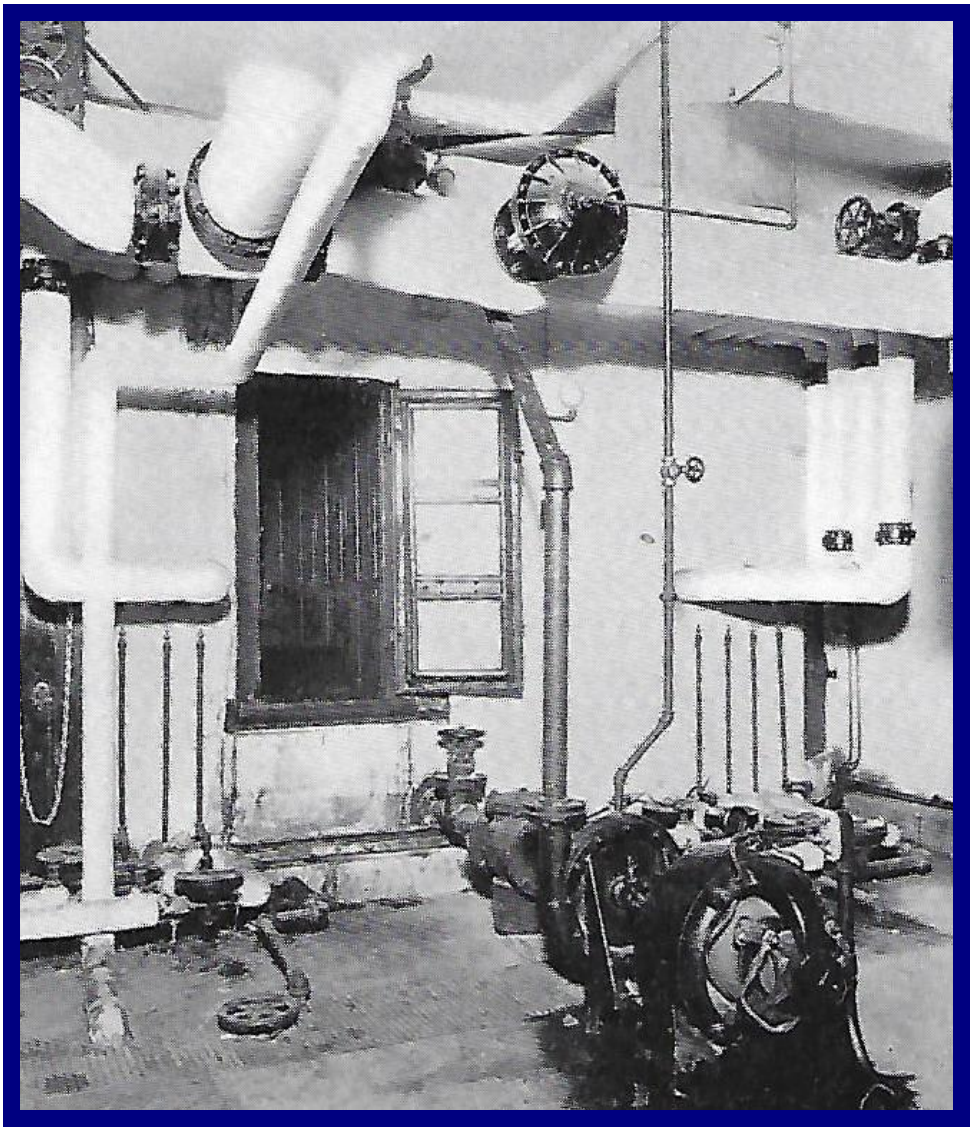
WOOLWORTH BUILDING NEW YORK 1913

Provided with 29 Otis Electric Elevators. Six Tower elevators maximum capacity 3000 lbs, speed 700 ft/min at 2500 lbs. A seventh elevator runs from 53rd floor to Observation Station. Technical details of elevators and controls are in "Master Builders," pp.45-50.

WOOLWORTH BUILDING NEW YORK 1913



Mechanical ventilation uses 19 direct-drive centrifugal fans by
C&C Electric Manufacturing Co.

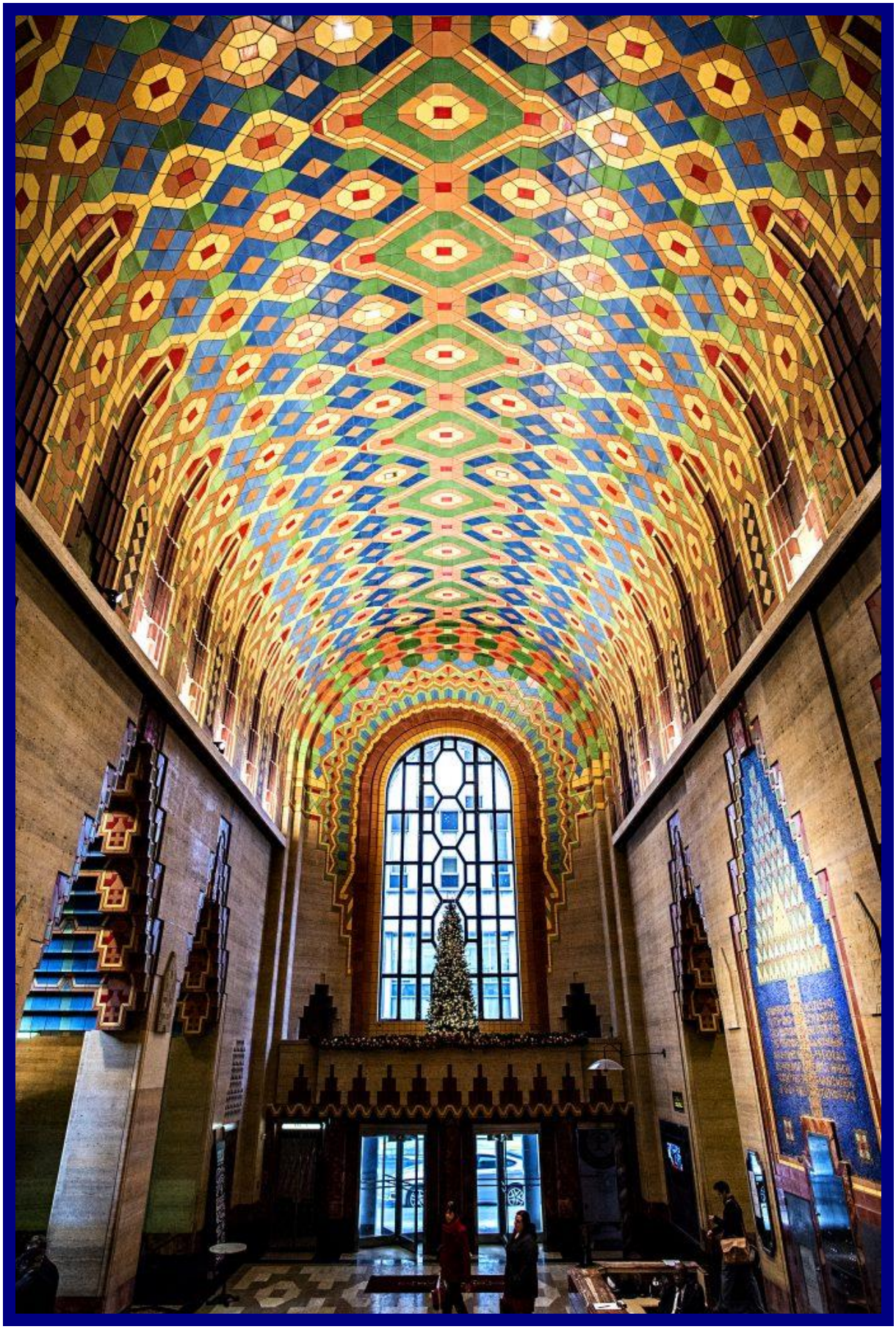


Specialist lower-level rooms served by Kinealy Air Washers.
Kauffman Heating and Engineering Co.

UNION TRUST BUILDING DETROIT 1929

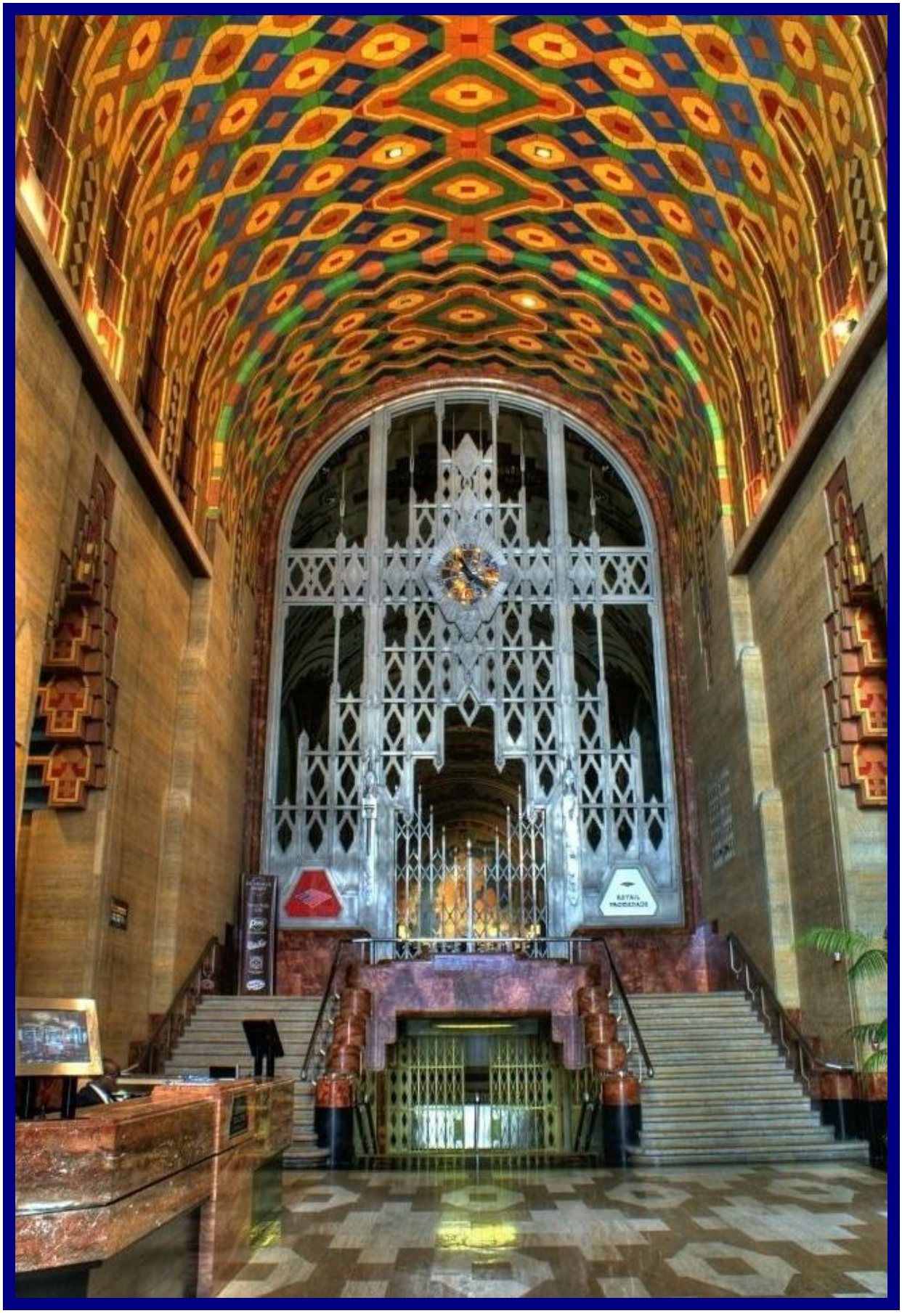
489 ft, 40 floors, with only Basement, Banking Hall and 10 floors of Bank Offices above Hall air conditioned. Floors above these offices, having natural ventilation, were to be leased. The Bank's air conditioning units and CO_2 refrigeration were manufactured by the American Carbonic Machinery Company. Units included spray washer chamber & direct-expansion coil.

UNION TRUST BUILDING DETROIT 1929



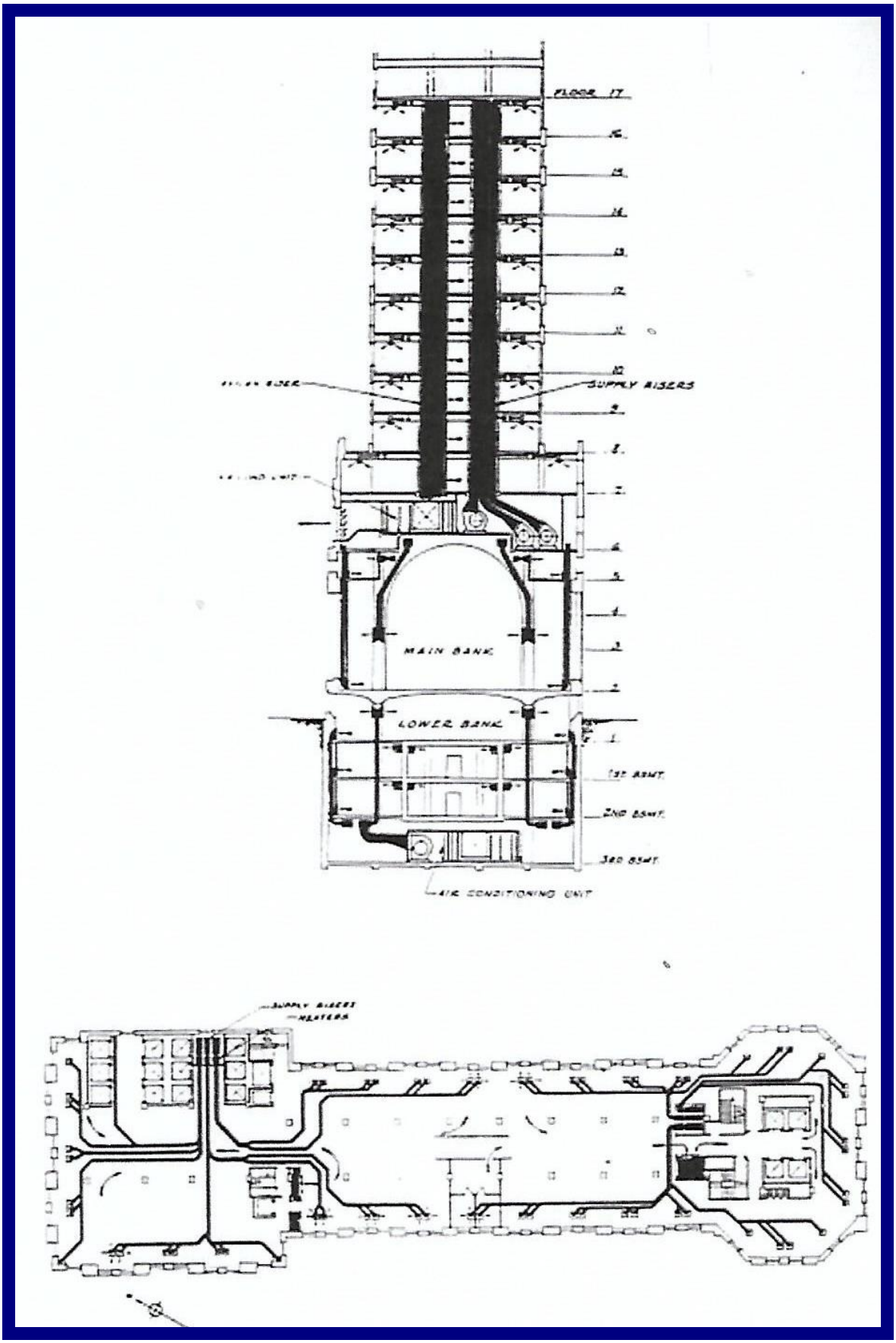
The Main Bank with elaborate decor on ceiling and walls.

UNION TRUST BUILDING DETROIT 1929



Now renamed Guardian Building.

UNION TRUST BUILDING DETROIT 1929



Cross-section of air conditioned floors and typical ceiling duct layout.
Air volume delivery all plants 193,000 cu.ft/min. Refrigeration 600 TR.

JOHNSON WAX BUILDING RACINE 1936

Frank Lloyd Wrights "top lit hypostyle" hall, with mushroom structural columns. Fresh air was introduced to the air conditioning from “nostril-type" roof inlets. Carrier were consulted but the contract went to York. Wright also introduced underfloor heating, possibly the first in the USA.

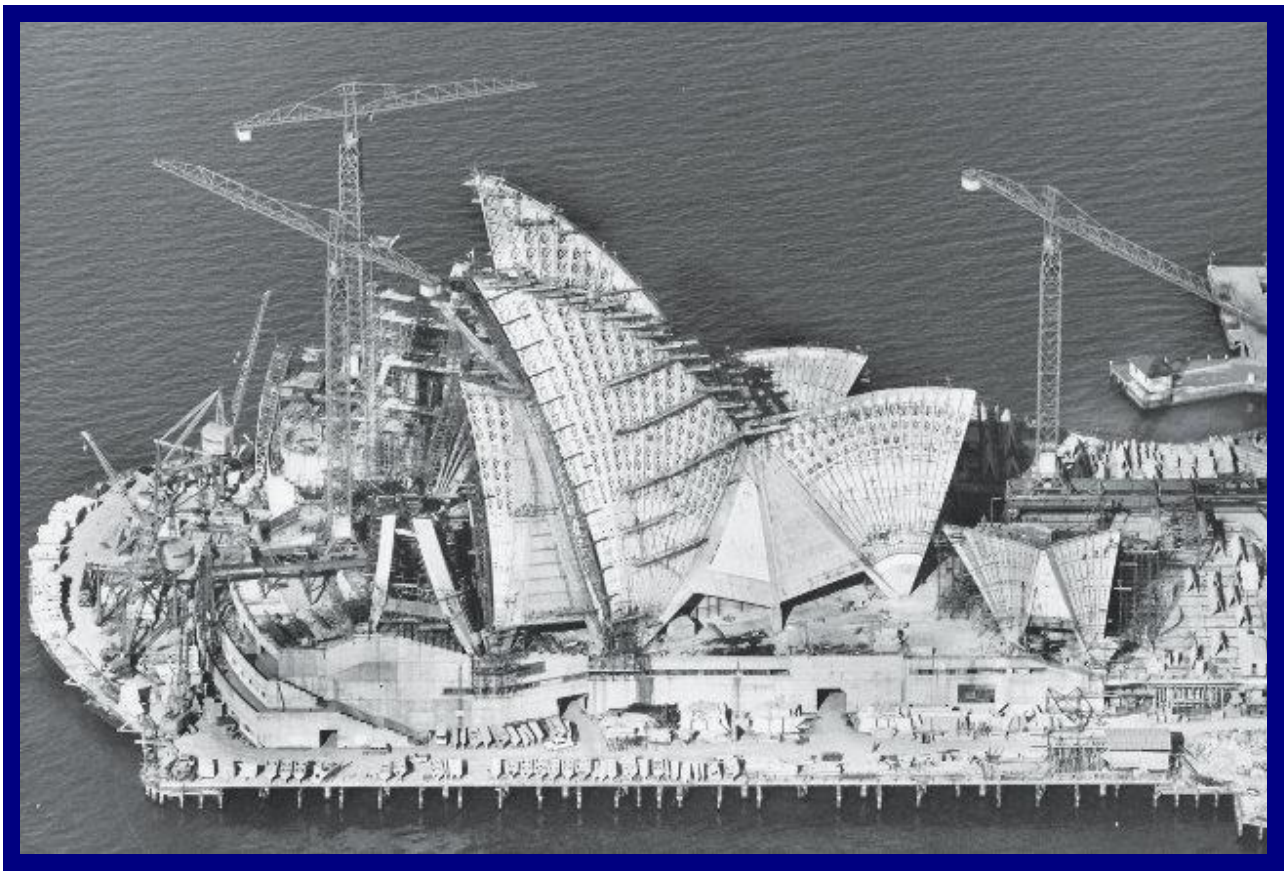
JOHNSON WAX BUILDING RACINE 1936

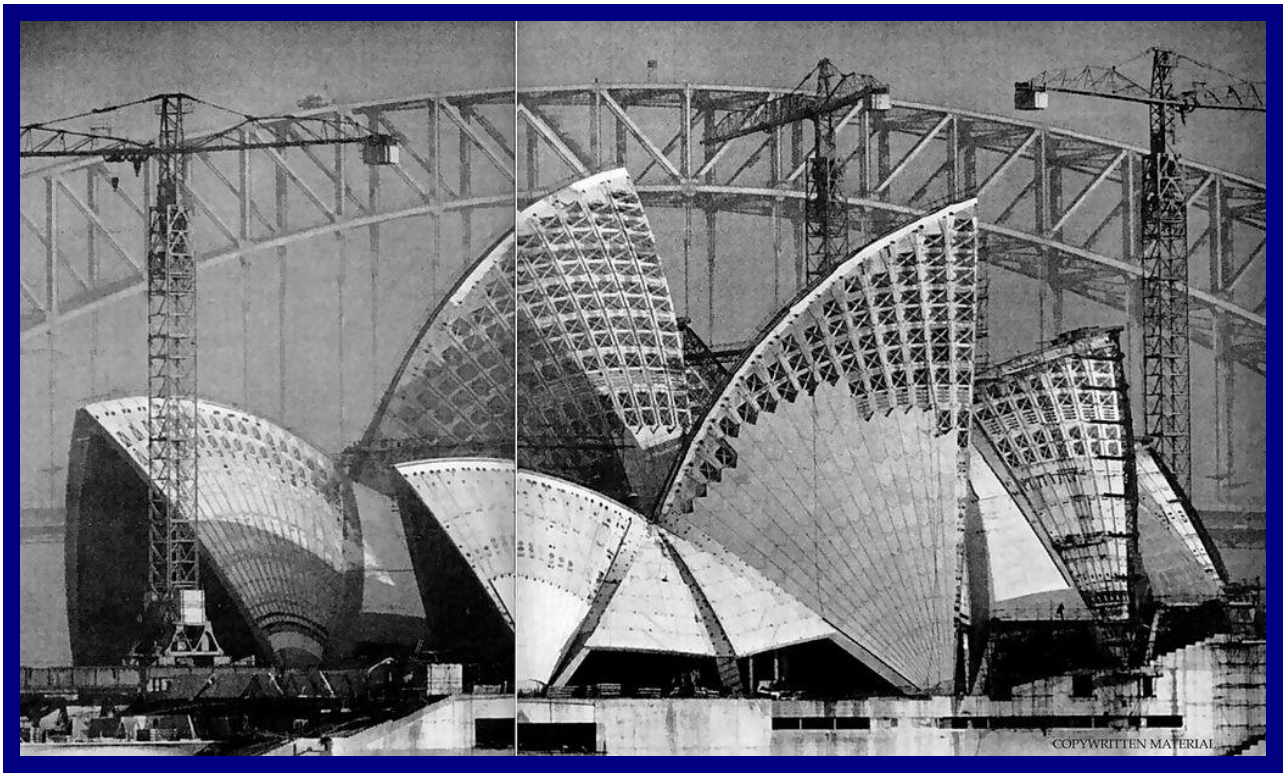
Wright witnessing a successful load test on one of his unusual mushroom structural columns. These were 21 ft high; the circular pad was 20 ft in diameter, the column tapering downwards to 9 inches in diameter, the pads interconnected at their tangent point to form a rigid frame.

SYDNEY OPERA HOUSE ALTERNATIVE 1956

I recently, for the first time, came across these illustrations of a proposed design for the Opera House to be sited in Sydney Harbour. It secured 3rd Prize in the Competition of 1956, but only the winning design was ever built and that took twenty years.
My interest is that, although I had no involvement with the Opera House, the architects for the above design were Paul Boissevain & Barbara Osmond and in the second half of the 1960s, for three years, I worked for them in their Epsom Office.

SYDNEY OPERA HOUSE 1976



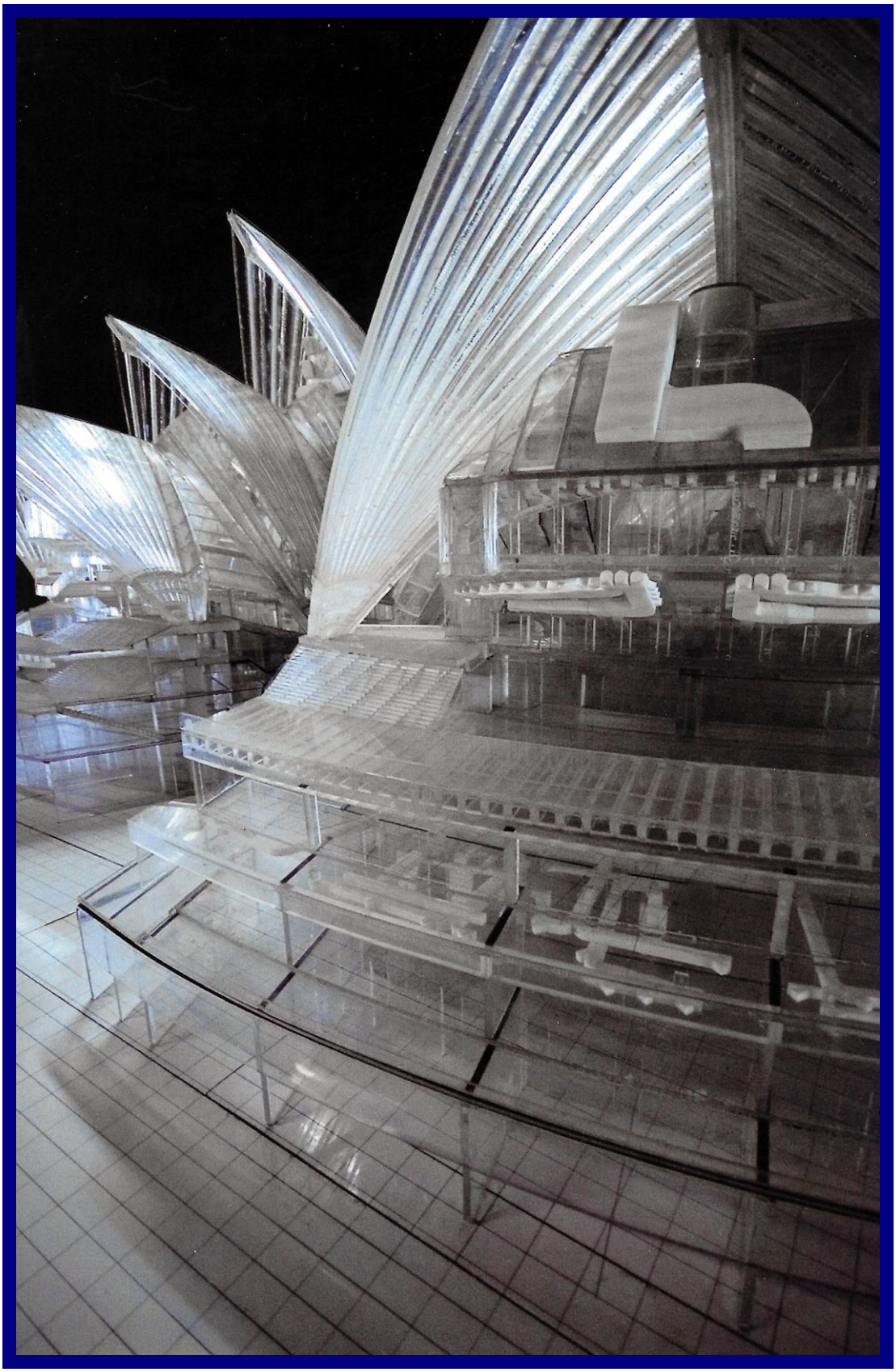


The buildings distinctive "sails" or "shells" (as they have been termed), proposed by the prize-winning architect, proved to be structurally impossible, until redesigned, at considerable time and cost, by Ove Arup & Partners.

SYDNEY OPERA HOUSE 1976

The completed Opera House.

SYDNEY OPERA HOUSE 1976



Air conditioning and mechanical services were designed by Steensen Varming and installed by Haden Engineering. A large clear plastic model was produced which included the air conditioning ductwork. The final installation is said to have required 20 miles of ducting and 8 miles of piping, together weighing more than 1000 tons. (See articles by Paul Yunnie).

SYDNEY OPERA HOUSE 1976

The water source heat pumps (1500 TR) using harbour water (6000 gals/min) as a heat source and heat sink served 27 plant rooms having over 100 individual fan systems. This arrangement avoided having a boiler chimney stack or cooling tower which would have upset the roof design.

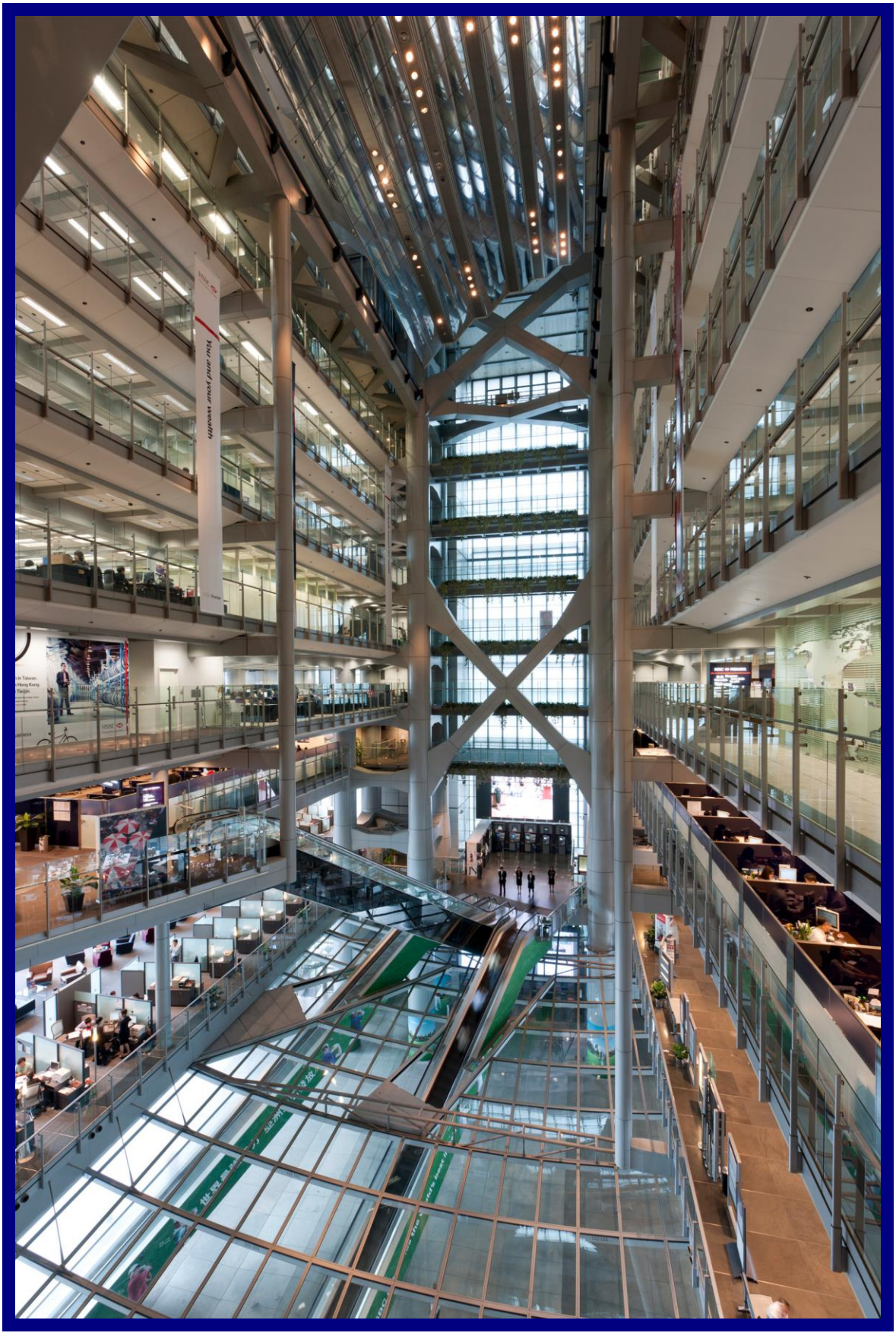
SYDNEY OPERA HOUSE 1976

The famous view.

HONG KONG SHANGHAI BANK 1986

587 ft, 44 floors. Architect (Norman) Foster & Partners. Built on the site of the demolished 1935 HKSB building, which was the first in Hong Kong to be air conditioned (installation by Haden).

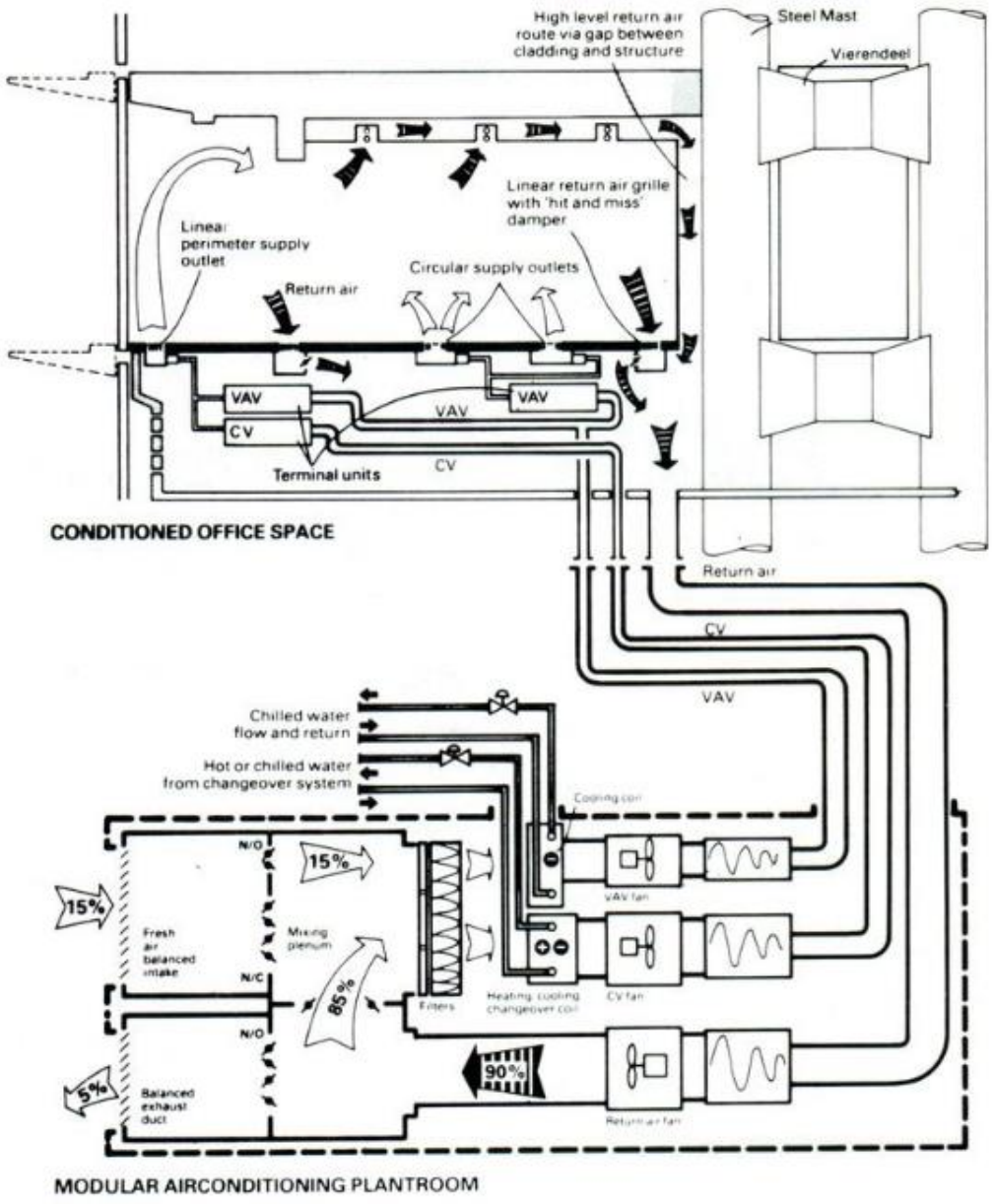
HONG KONG SHANGHAI BANK 1986



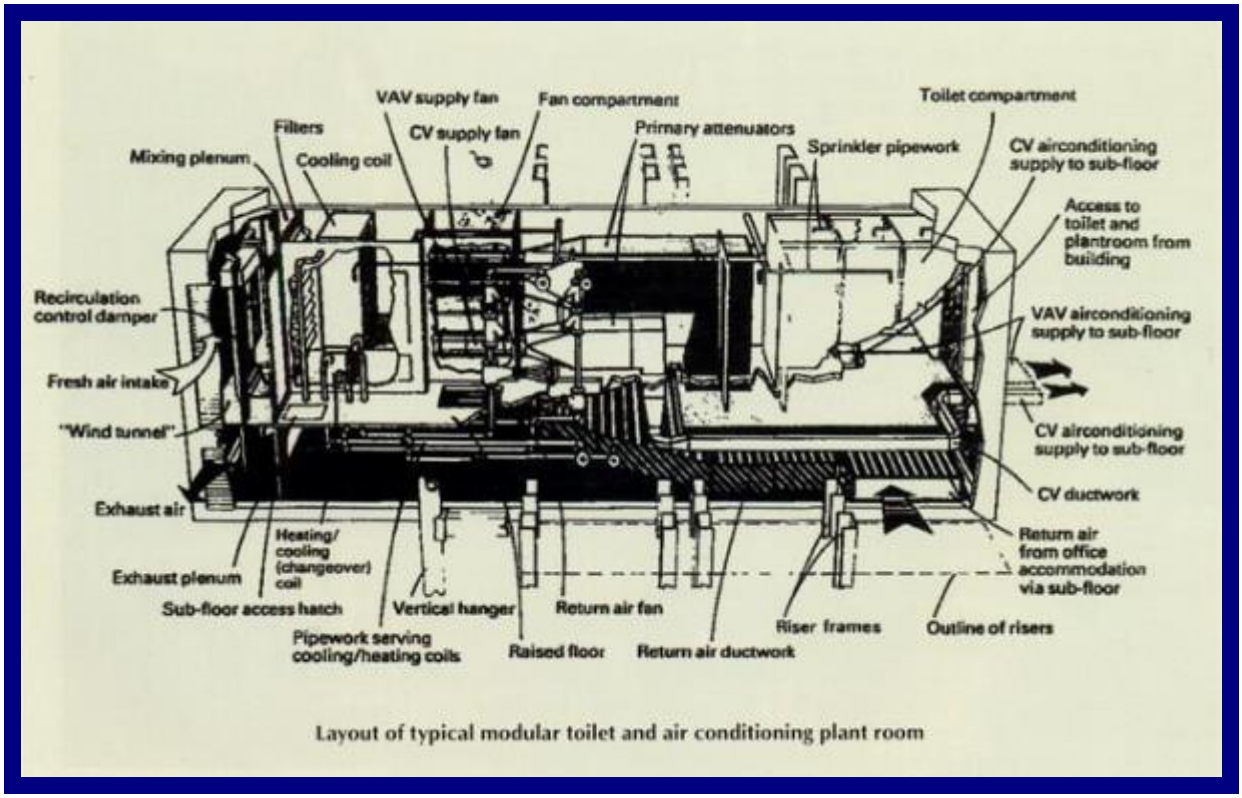
The multi-storey atrium with groups of floors interconnected by escalators.

HONG KONG SHANGHAI BANK 1986

Figure 15: Diagram of air circulating systems for typical floor



HONG KONG SHANGHAI BANK 1986



Layout of typical modular toilet and air conditioning plant room

Design of the combined air conditioning-bathroom prefabricated plant room.
Services consultant J. Roger Preston & Partners.

The refrigeration-heat pump installation by Drake & Scull (6 machines, 2 for heating) using sea water condensing via titanium plate heat exchangers.

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