



German Medical Book, with Masonry Heating Stove (Kachelofen) by rear wall 1566.

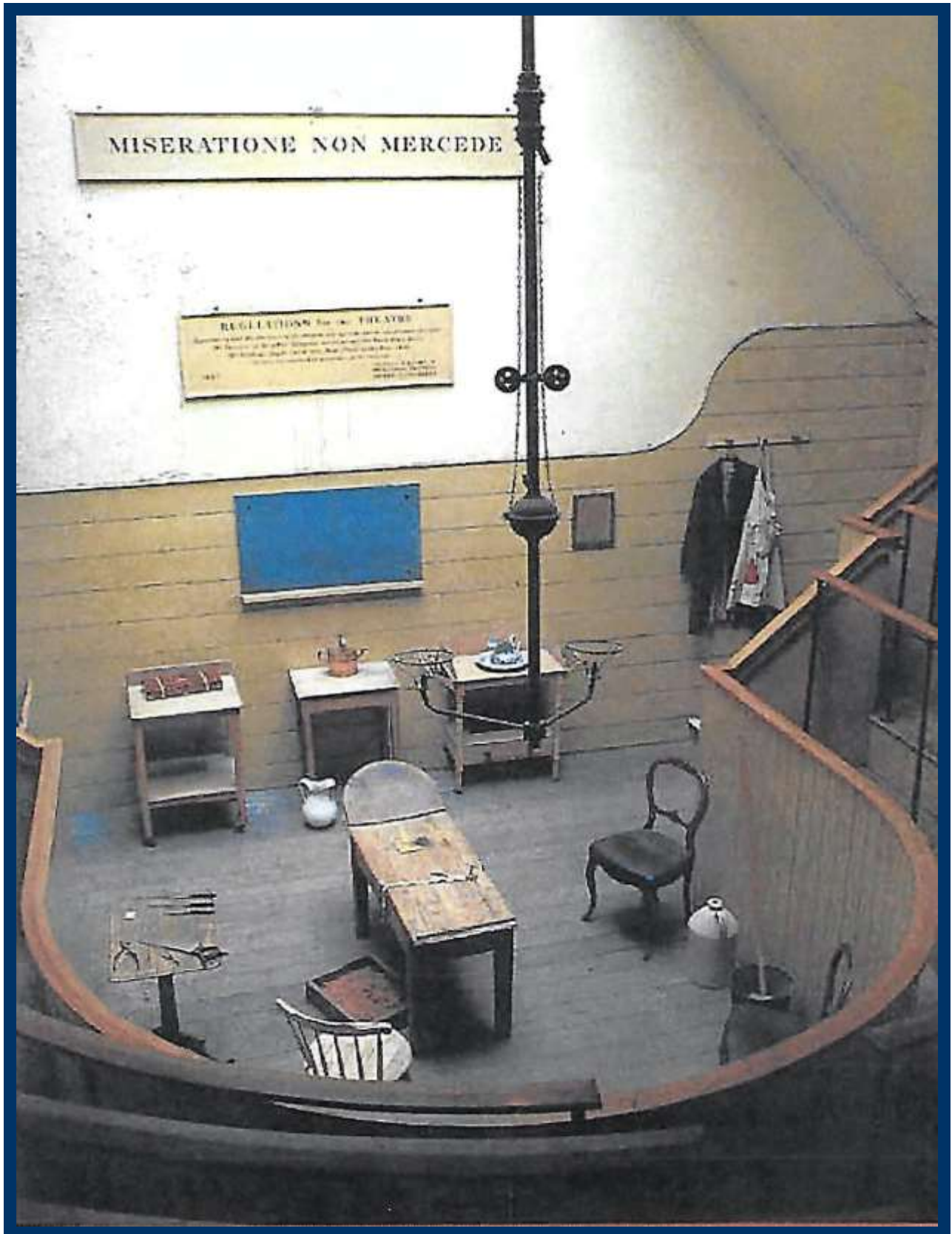
HISTORIC HOSPITALS

BRITISH, EUROPEAN AND AMERICAN EXAMPLES

NOTES ON ENGINEERING SERVICES

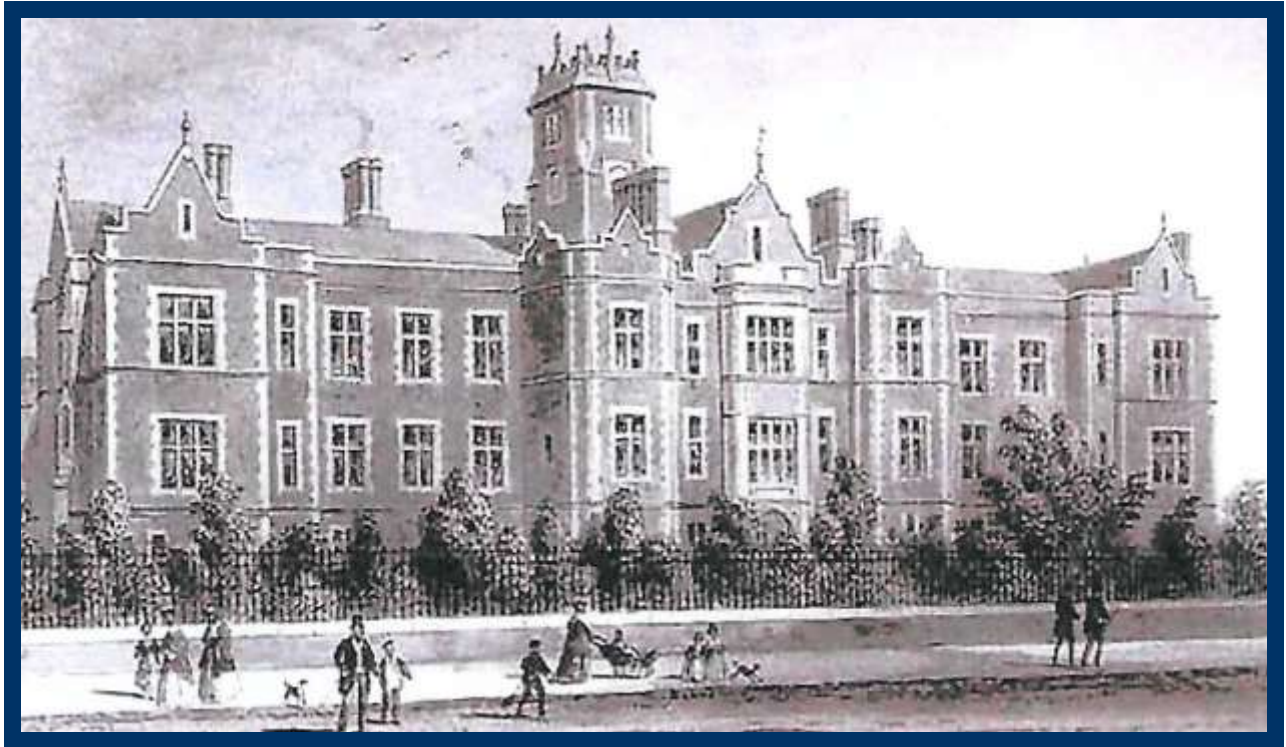
BRIAN ROBERTS

ST. THOMAS OPERATING THEATRE 1821



The Old Operating Theatre at St Thomas's Hospital London, dating from 1821.
Discovered in 1956 in the Chapter House of Southwark Cathedral.
The wall sign translates as *Act out of compassion and not for gain.*

BROMPTON HOSPITAL LONDON 1879



Brompton Hospital for Consumption, 1879. Architect Thomas Henry Wyatt.
Heating by G. N. Haden & Sons.

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INTRODUCTION

For many centuries looking after the sick was carried out by religious orders. The conditions in many early hospitals were frightful, sometimes with two or more patients in a single bed. One intended 15th century scheme for a Milan hospital proposed that water be stored in a cistern and conducted through vaulted passages along the wards and then down to a river. Another set of passages were to contain lavatory seats with access by trapdoors between the beds.

A late 17th century hospital design proposed an octagon centre with sixteen radiating wards. The centre was to carry a dome "which served the purpose of sucking out used air." In Great Britain, the 18th century saw a dramatic rise in the building of hospitals, including famous London establishments such as St. Bartholomew's, St. Thomas's and Guy's.

In France, in 1773, a hospital ward was described as "a machine for treating the sick." One scheme had wards with ample ventilation ducts in the roof, since lack of ventilation was thought to be a major factor in the high mortality rates then being experienced in some hospitals.

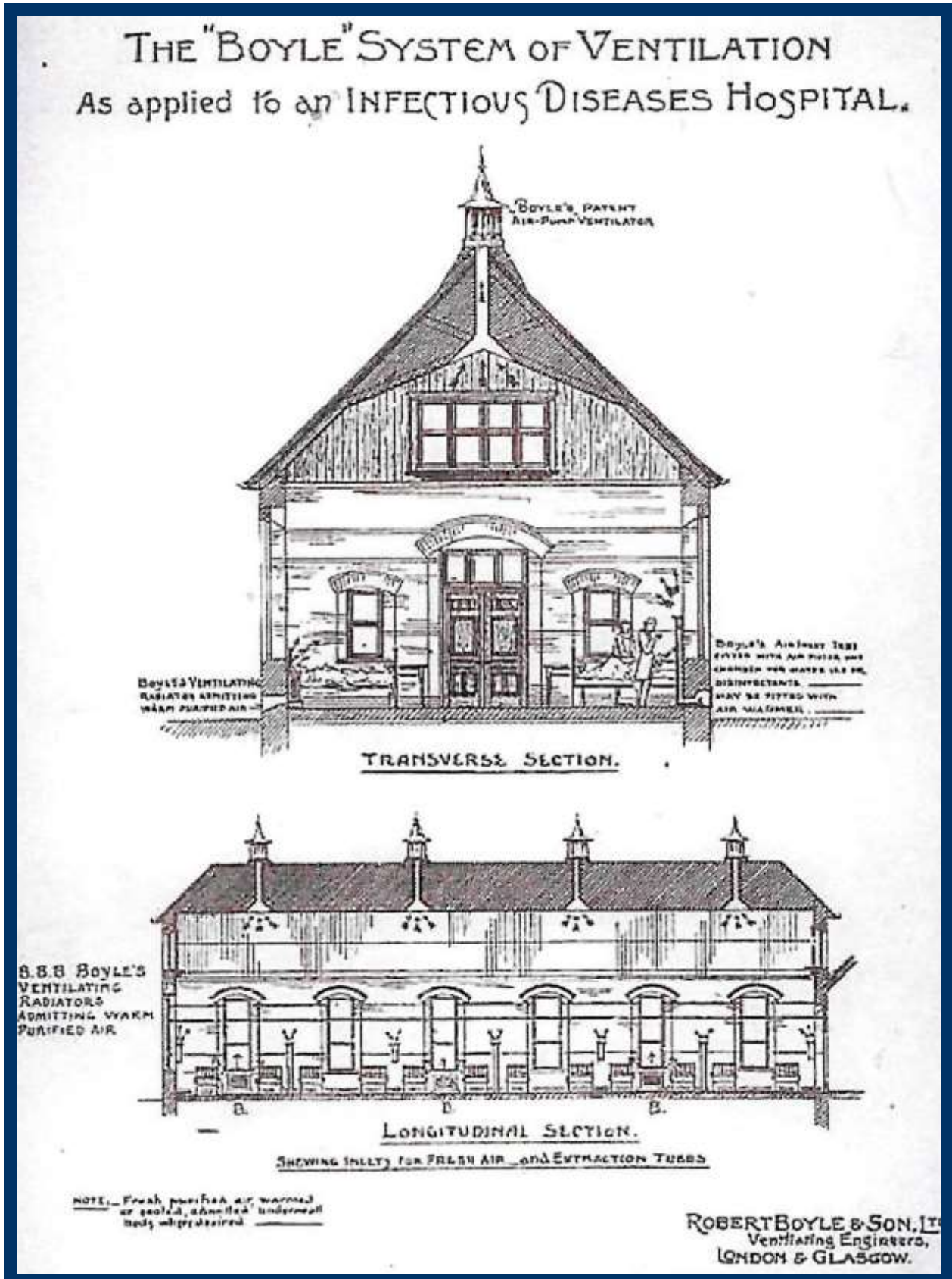
During the Crimean War, Florence Nightingale demonstrated the importance of proper hygiene when she reorganised the military hospital at Scutari, reducing the death rate by some 40%. Despite her impassioned pleas, in the design of the military hospital at Netley, near Southampton (1856-63), her recommendations were ignored. However, a revolutionary design was Brunel's prefabricated hospital erected in the Crimea.

The design of Victorian hospitals in England saw increasing emphasis on providing warming and ventilation, proper sanitary and washing facilities, kitchens and laundries. In some wards, heating continued to be provided by fireplace and ventilation by opening windows, and in many hospitals this continued until Victorian times (even in some Operating Theatres). However, the 20th century saw the adoption of hot water heating by radiators.

In the United States, hospital development was spurred on by the Civil War, many examples of Union facilities being set up in and around Washington DC, while improved ventilation soon followed (as in the system of aspirating chimneys in the 1880s at the John Hopkins Isolation Hospital in Baltimore).

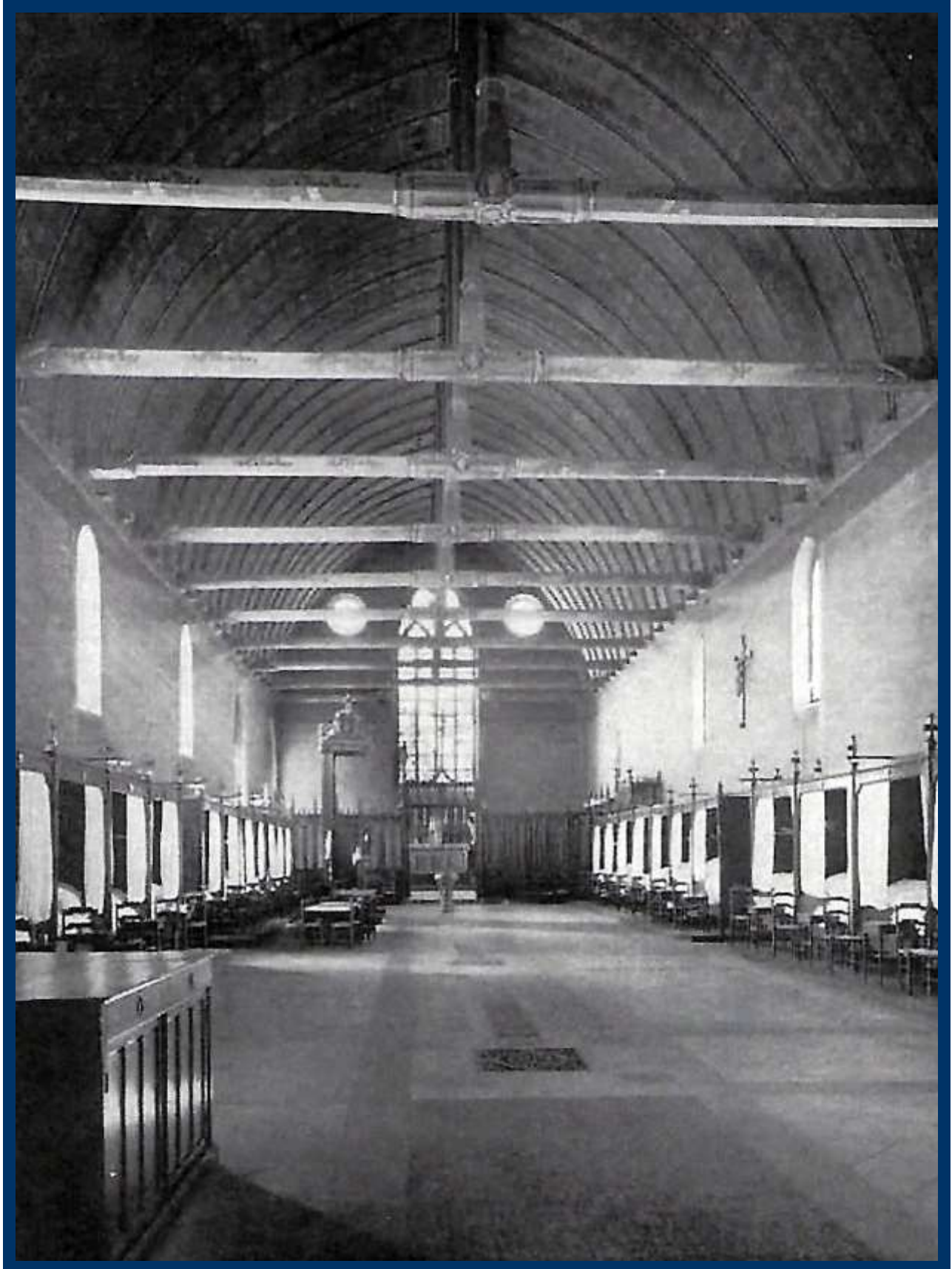
After the Second World War, English Hospitals introduced a number of schemes to provide safer working conditions in Operating Theatres, starting with systems of mechanical ventilation. In the 1960s, a trial with a prefabricated theatre was carried out. Then air conditioning, with mechanical refrigeration, was employed. Full air conditioning for ward blocks remained unusual though an exception in 1978 was the 21-storey Hallamshire NHS Teaching Hospital in Sheffield which was fully air conditioned, being provided with six 500 TR absorption water chillers (3000 TR total).

INFECTIOUS DISEASES HOSPITAL 1900 BOYLES AIR PUMP VENTILATOR



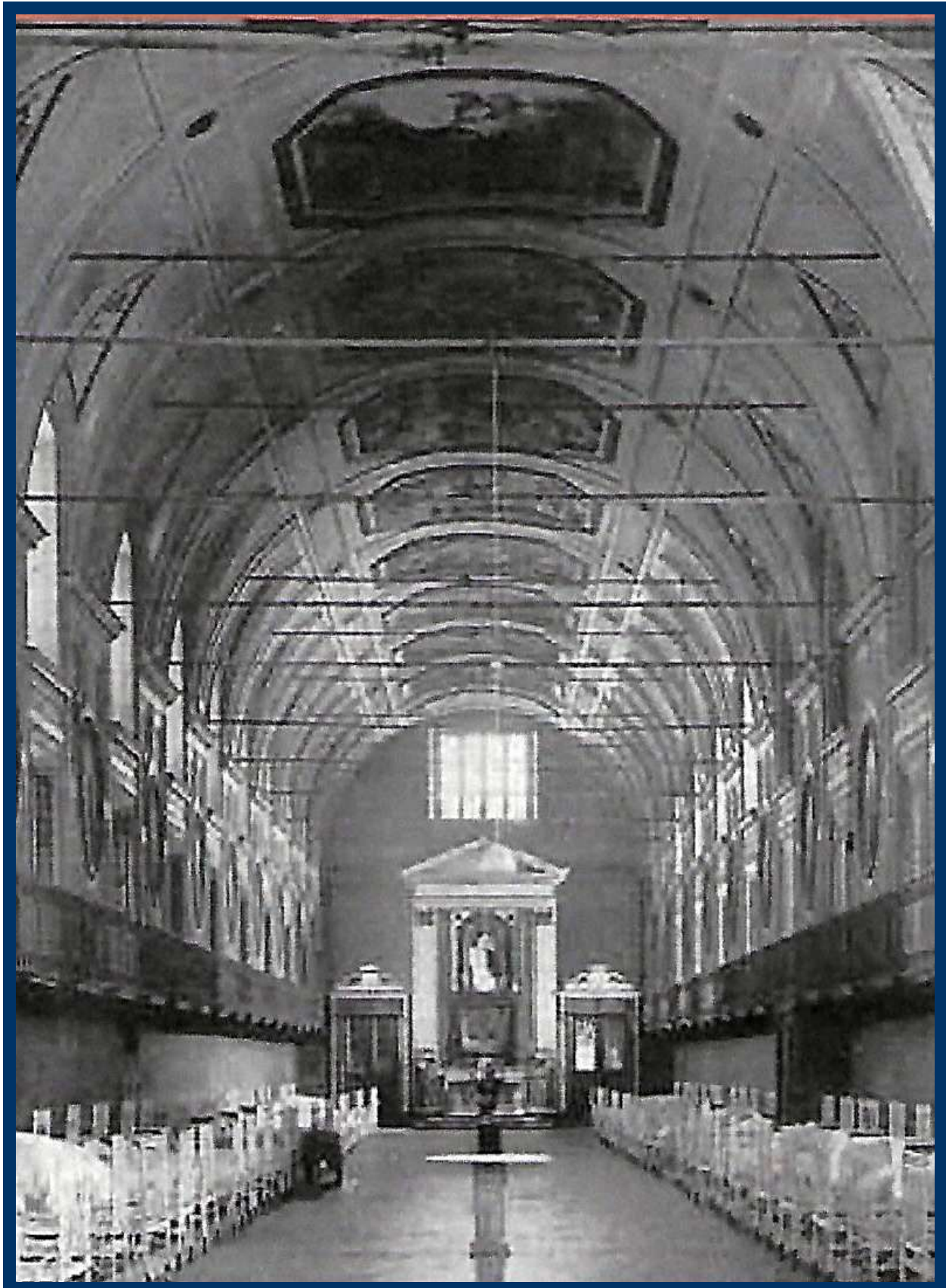
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BEAUNE MEDIEVAL HOSPITAL 1451



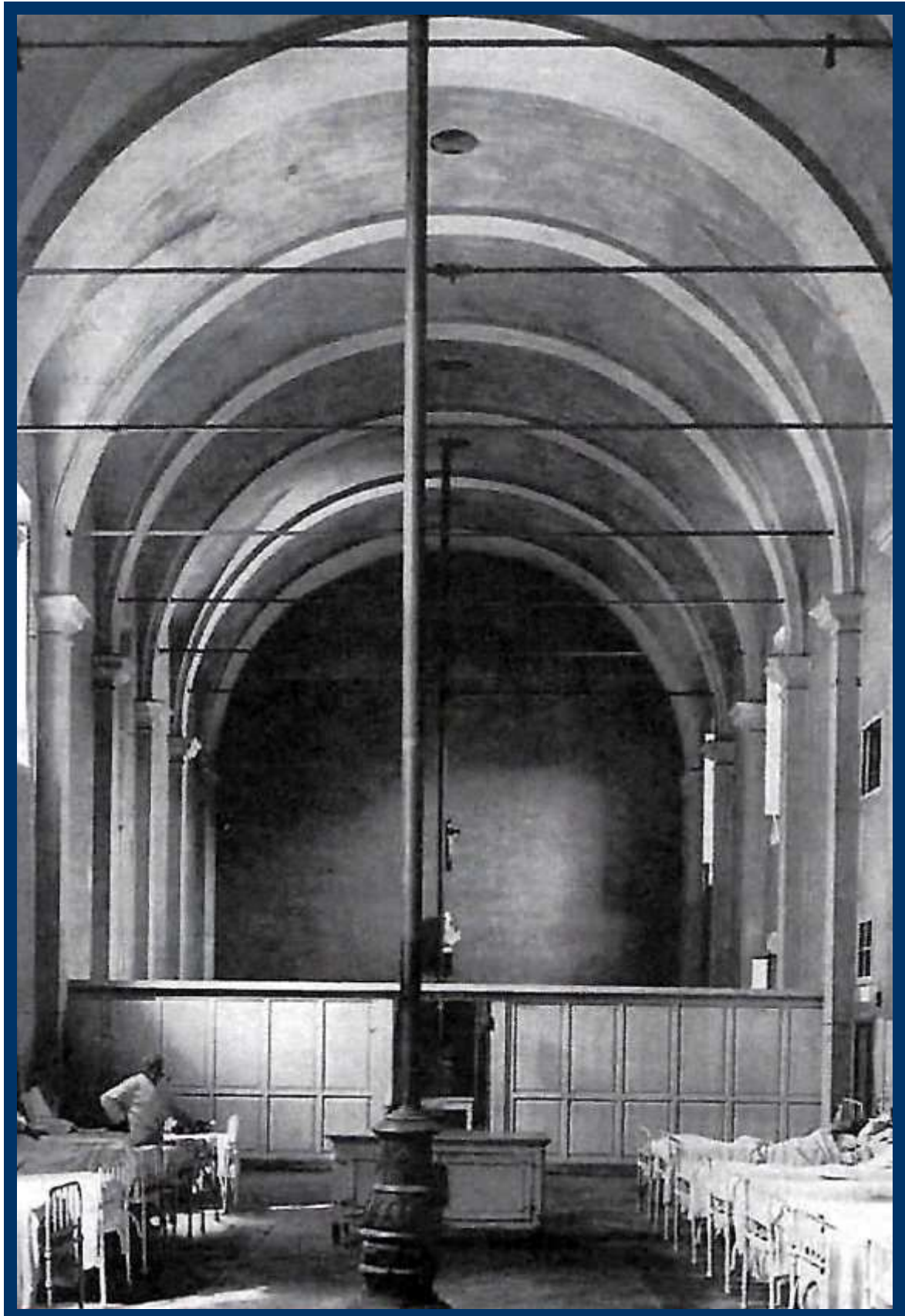
Hotel-Dieu, France, interior of hospital hall built 1443-51.
Considered one of the most beautiful medieval hospitals in Europe.

NAPOLI MEDIEVAL HOSPITAL 1765



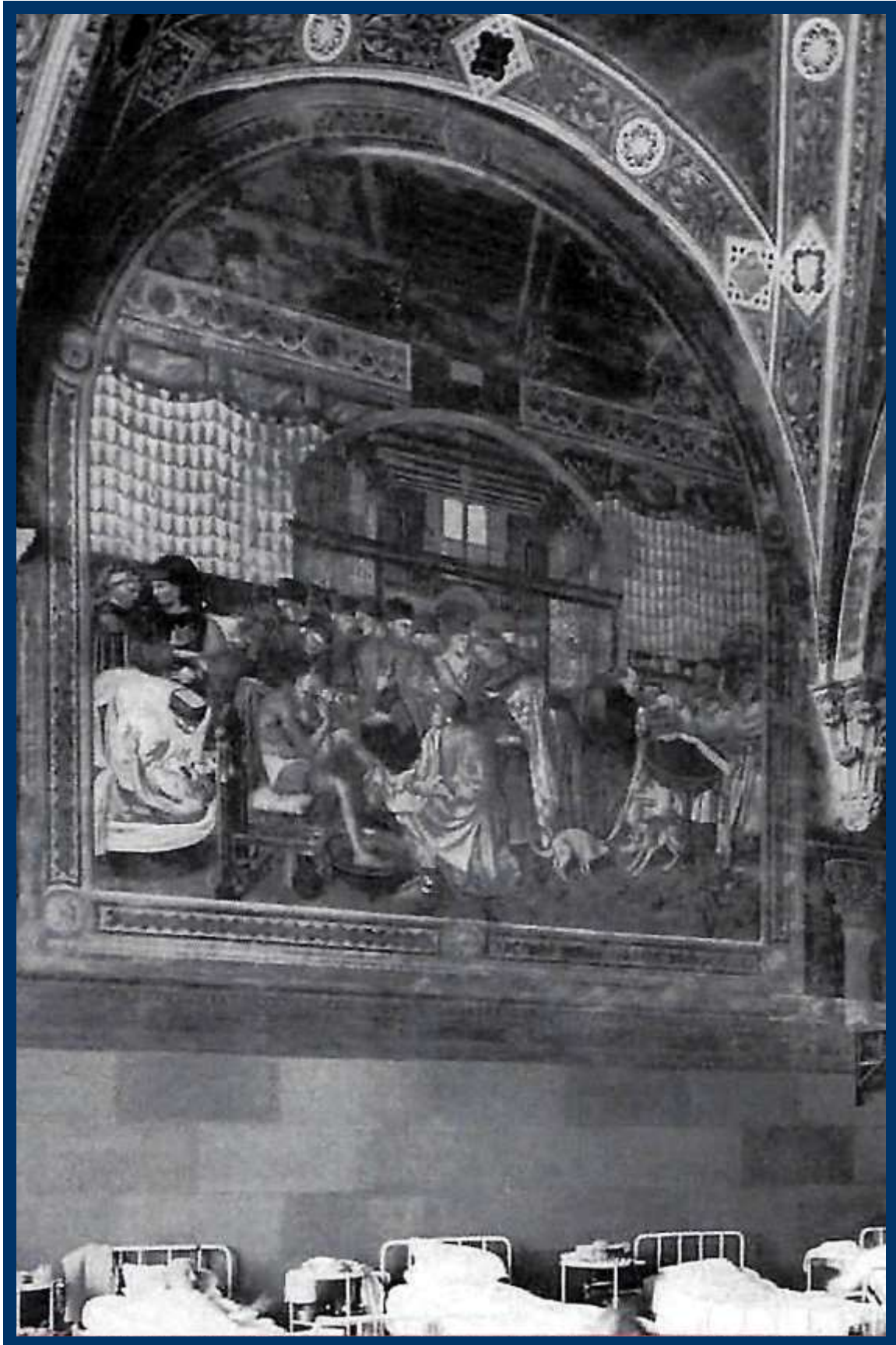
Ospedale di S. Maria, Napoli, Campania, Italy. Originally a Palace in 1500. In 1571, donated to Friars for a hospital, but converted to a monastery, combining chapel and hospital, opening in 1620. Converted and extended with barrel-roofed ward c.1765.

PRATO MEDIEVAL HOSPITAL 1700



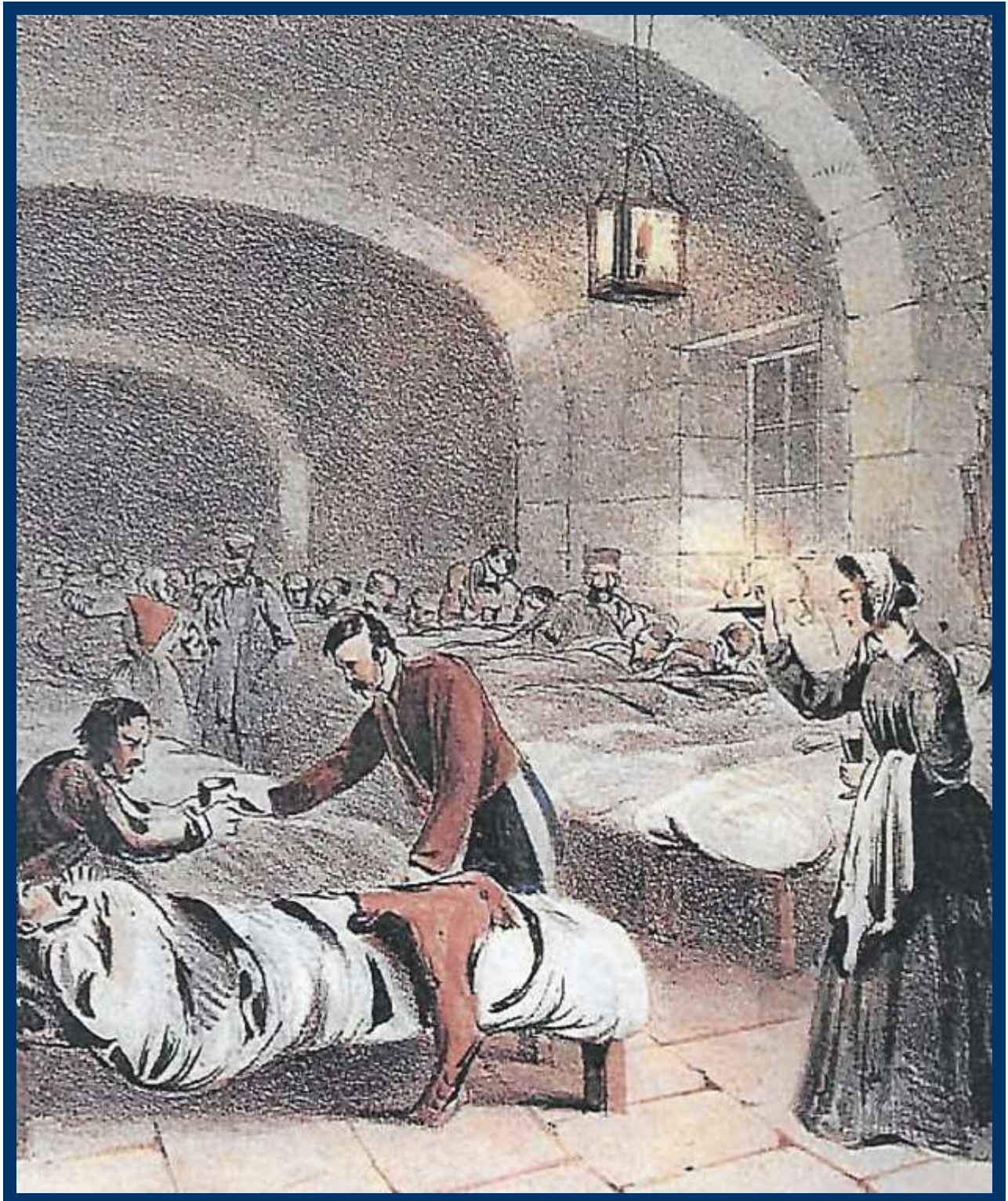
Spedale della Misericordia e Dolce, Prato, Toscana, Italy founded 1218.
One of the wards, complete with heating flue and very tall flue.
Additional building 1250, renovated and converted c.1700 and after.

SIENA MEDIEVAL HOSPITAL 1442



Ospedale di S. Maria della Scala, Siena, Toscana, Italy. Main building 13th century.
Considered the best preserved medieval hospital in Italy, frescoes c.1442.

HOSPITAL WARD SCUTARI TURKEY 1855



Drawing of Hospital Ward at Scutari with Florence Nightingale and her lamp, thought to be incorrect. It is now believed she used a so-called *Turkish* lamp which contained a candle within a circular collapsible shade (a pleated vertical cylinder).

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KITCHEN SCUTARI HOSPITAL 1855



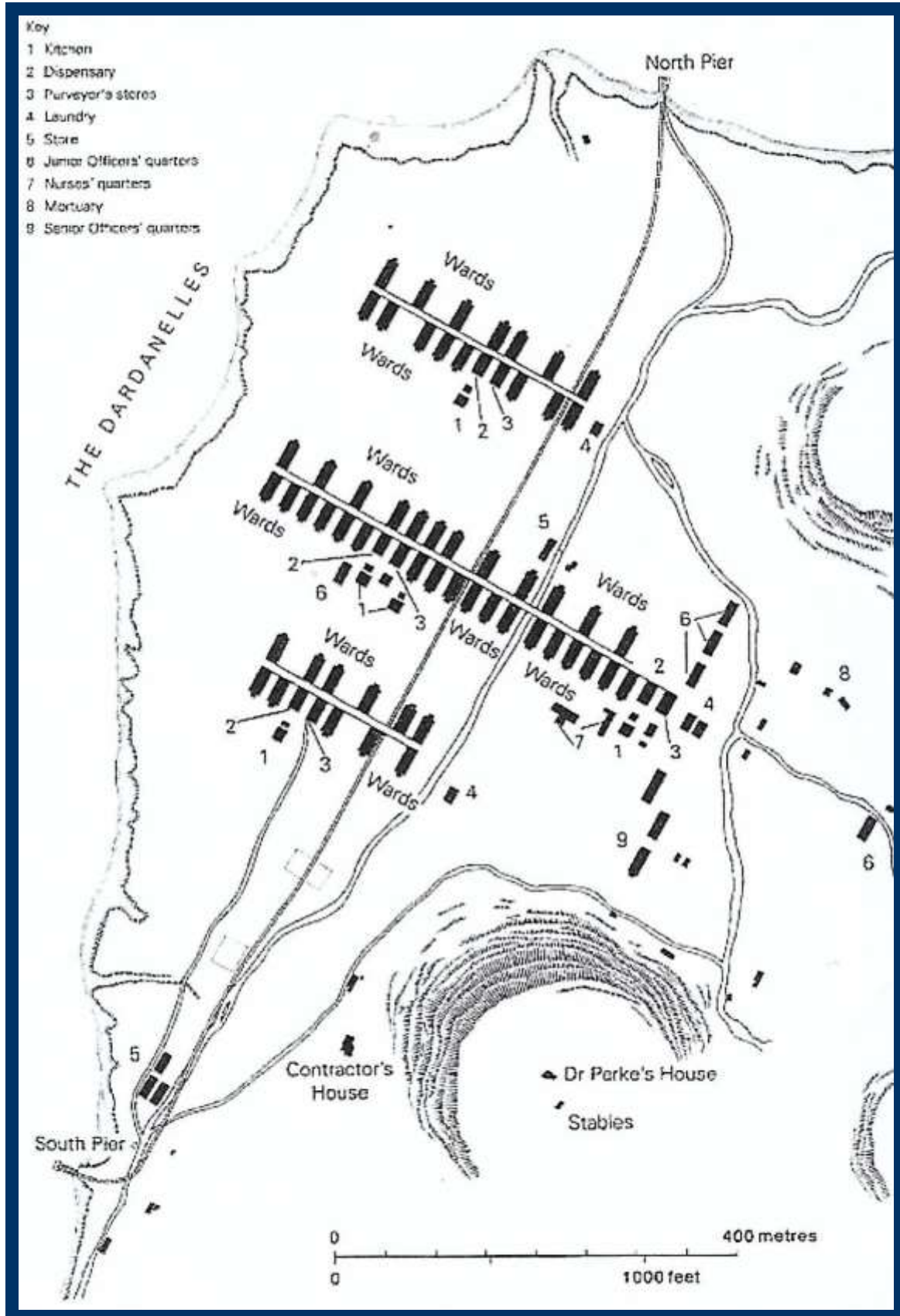
Kitchen of Alexis Soyer (previously chef at London's Reform Club) with boiler and a solid-fuel cooker, both with horizontal flues.

ROYAL VICTORIA HOSPITAL NETLEY 1900



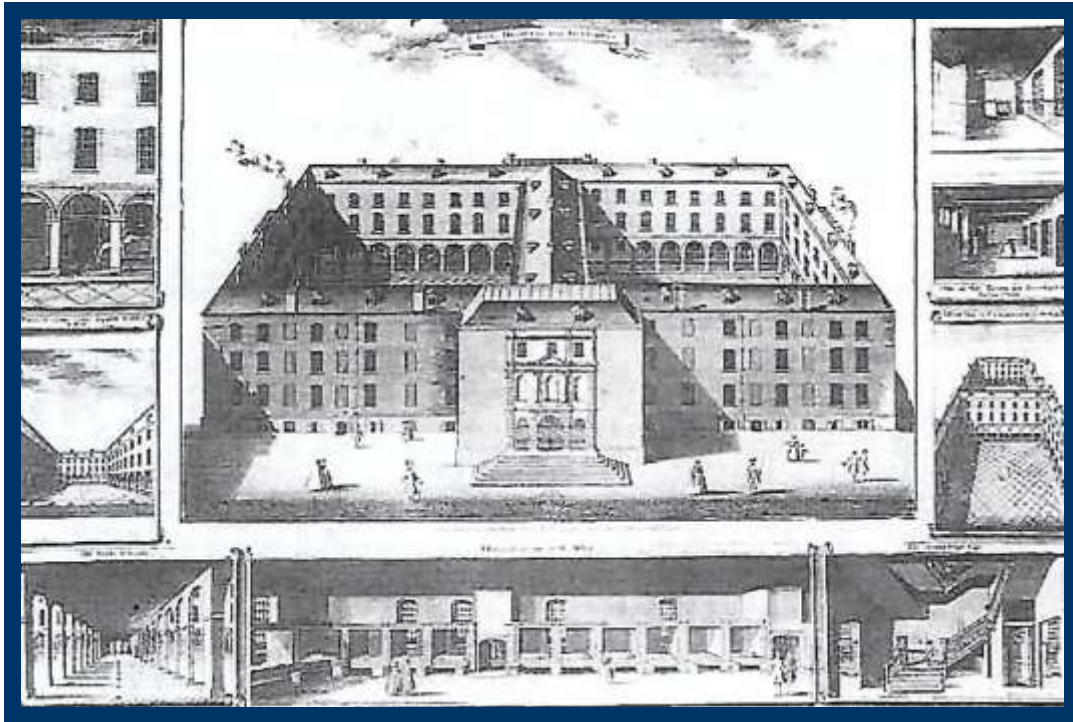
Military Hospital with patients from the Boer War: Box-End tubular radiator (right foreground).

RENKIOI HOSPITAL TURKEY 1856



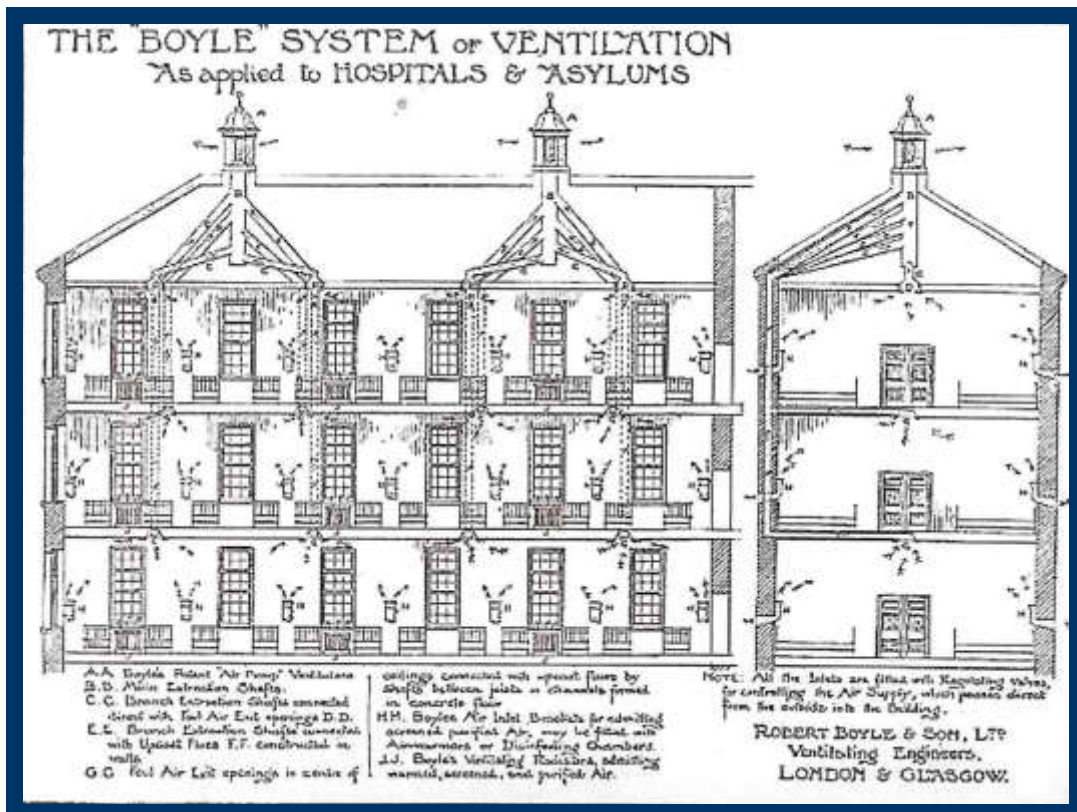
Site Plan of I. K. Brunel's innovative prefabricated military hospital.

GUYS HOSPITAL LONDON 1725



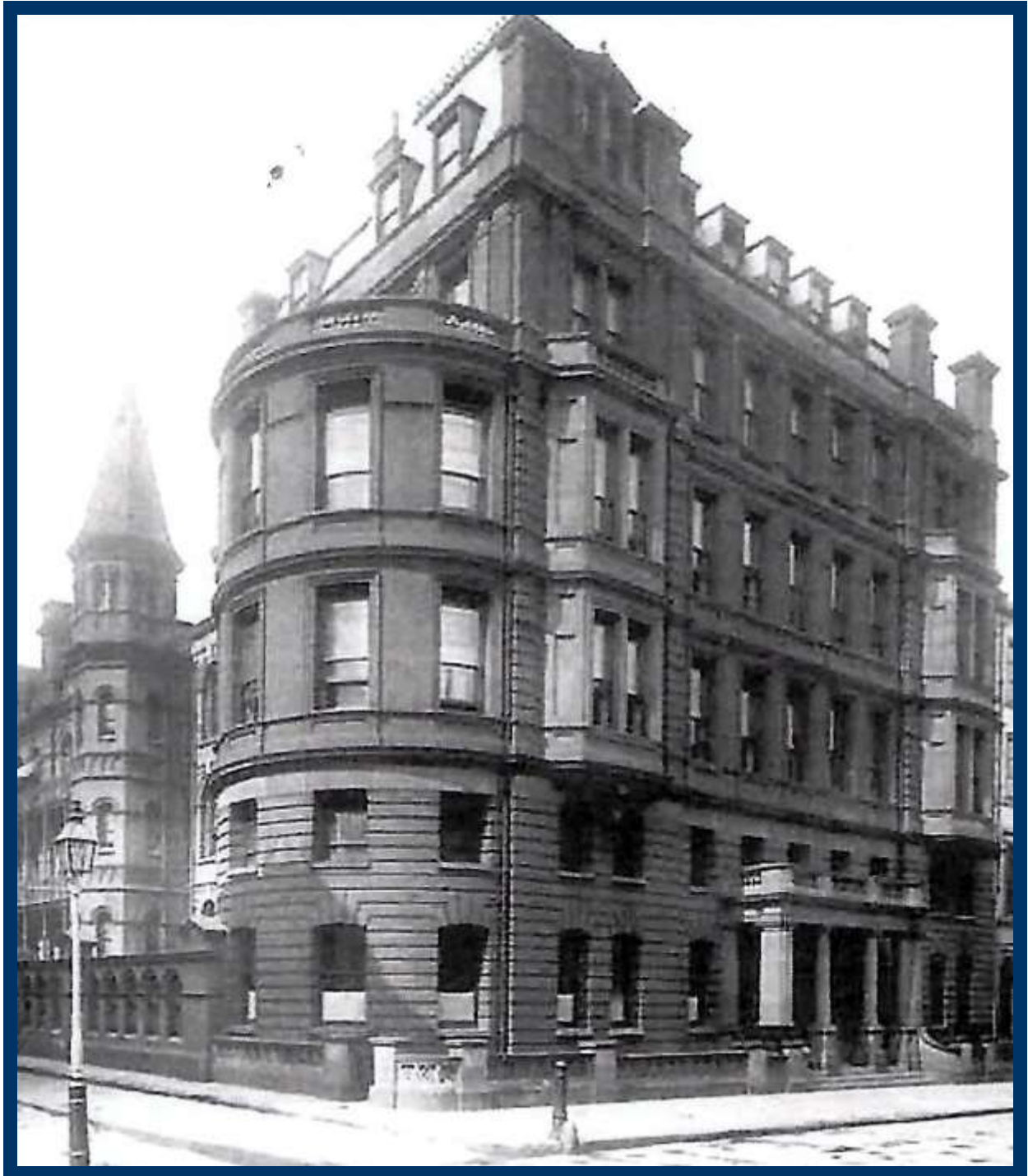
With individual beds in cubicles and heating by a fireplace.

BOYLES HOSPITAL VENTILATION 1900



Hospital ventilation by natural means c.1900.

GREAT ORMOND STREET LONDON 1893



The Hospital for Sick Children in about 1893. Original building (left) architect E. M. Barry.
Jubilee Wing (right) architect Charles Barry.

In 1929, the author James Barrie gave the hospital the full copyright of his story "*Peter Pan*."

PARK HOSPITAL LEWISHAM 1897



View of sanitary towers at the ends of the Ward Pavilions, 1897.

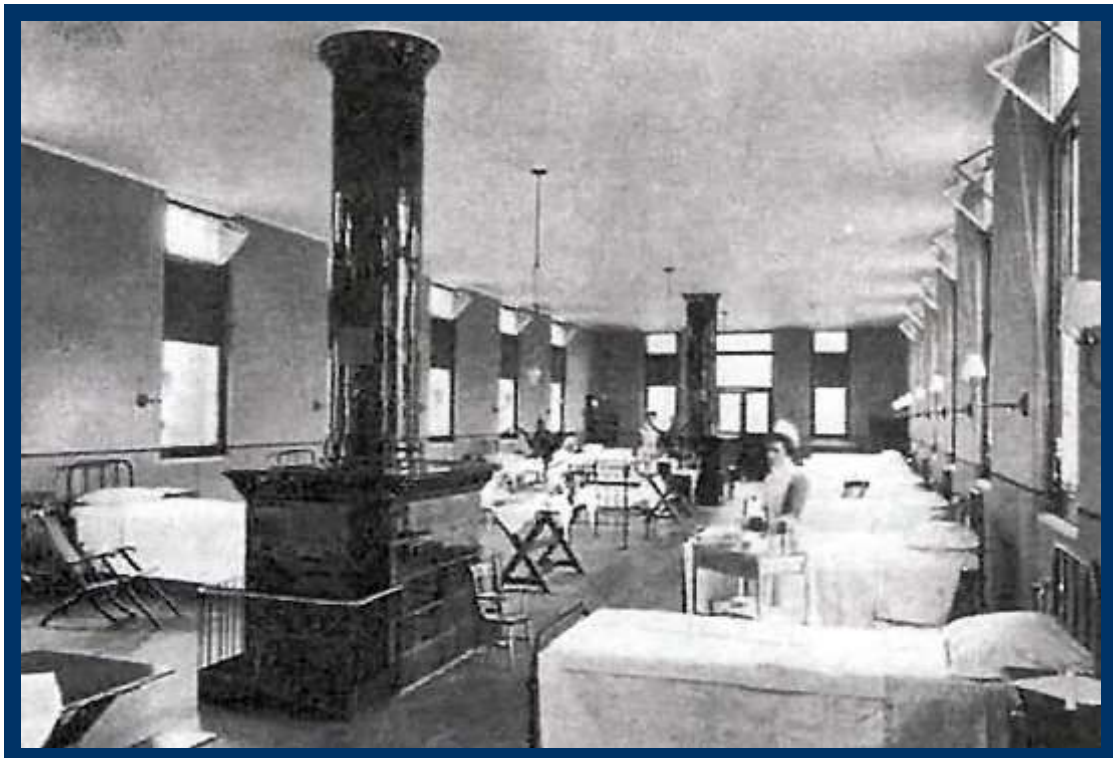
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FREE CANCER HOSPITAL LONDON 1893



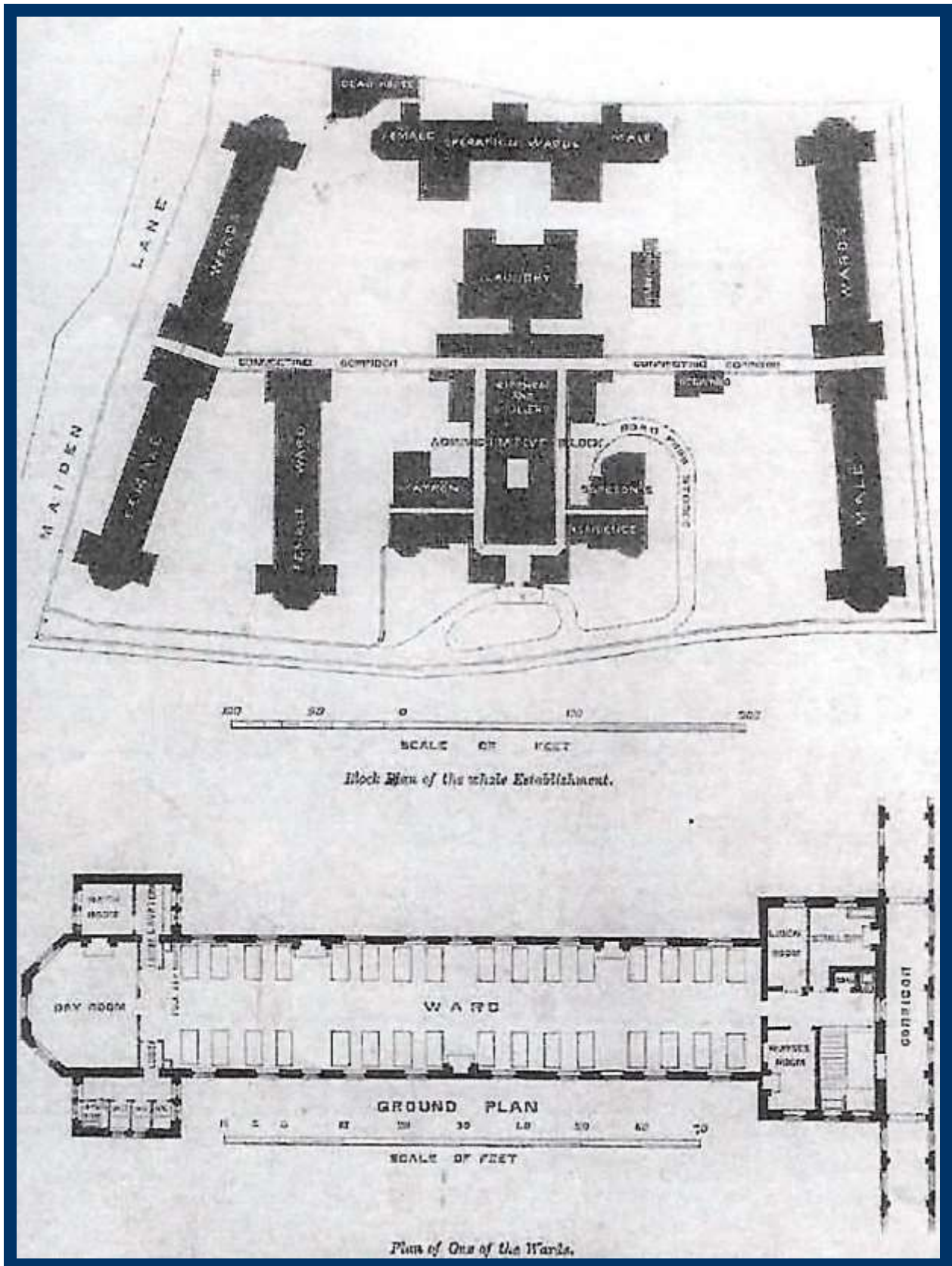
Women's Ward (now Royal Marsden, rebuilt 1893). Heating by open fireplace.

PARK HOSPITAL READING 1906



Scarlet Fever Ward. Notice the two sets of heating apparatus.

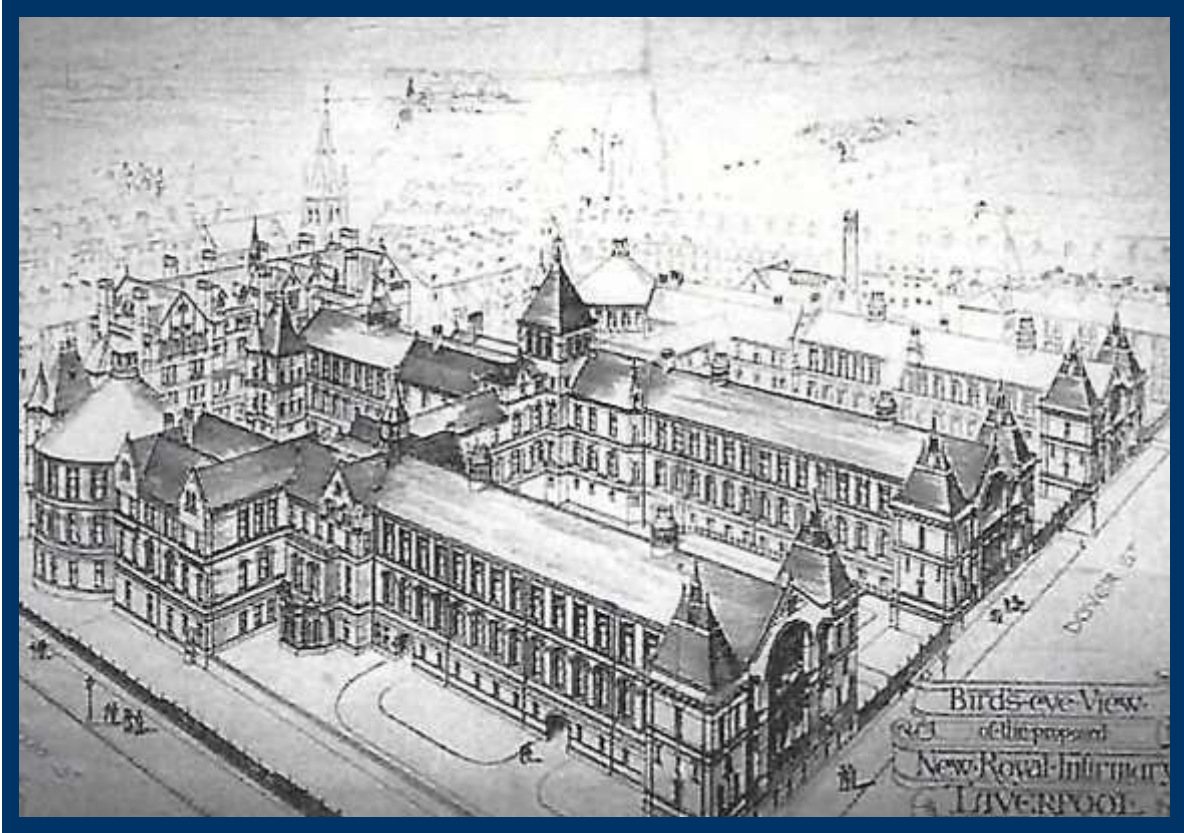
ST. PANCRAS INFIRMARY LONDON 1869



Infirmary at Highgate. Block & Ward Plans which show that sanitary facilities were not separated by ventilated lobbies at the time (1869).

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ROYAL INFIRMARY LIVERPOOL 1890



Architect: Alfred Waterhouse. Incorporated two circular Ward Blocks.
Heating by Wilson W. Phipson.



Opening of the Outpatient's Department, 6 March 1911.

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ROYAL INFIRMARY LIVERPOOL 1890-1911



One of the circular ward blocks. Note ornamental radiator (left).



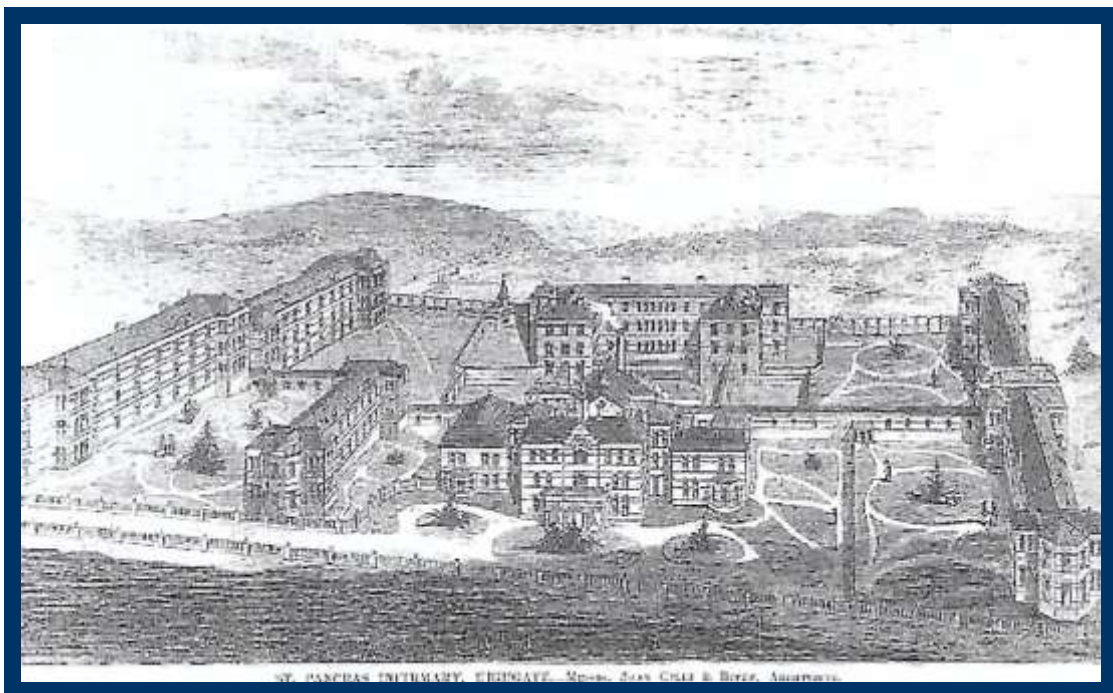
No.9 Ward at the Infirmary, May 1911.

GUYS HOSPITAL LONDON 1887



Visiting time in the Accident Ward: heated by open fireplace (far end, right-hand wall).

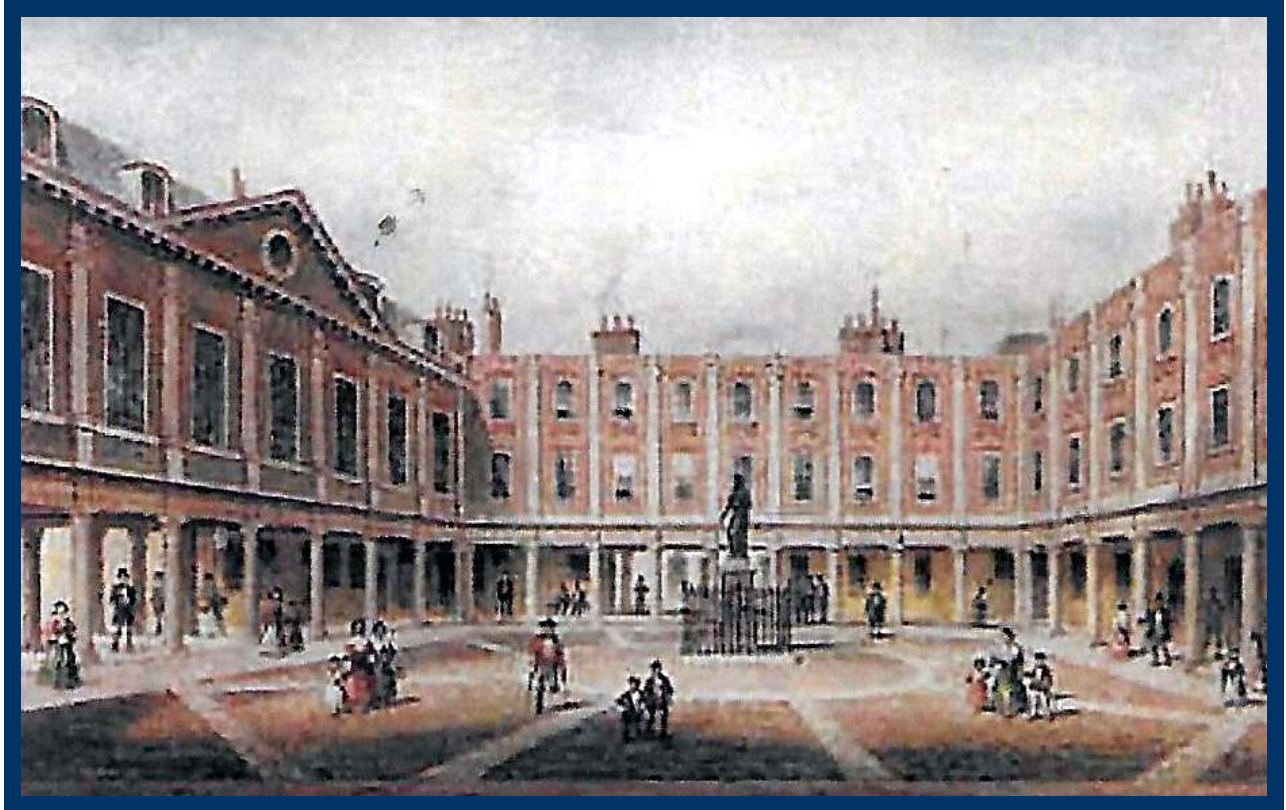
ST. PANCRAS INFIRMARY LONDON 1870



A 524-bed Infirmary with Central Laundry (see chimney), 1870.

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ST. THOMAS HOSPITAL LONDON 1858



Quadrangle of the old St. Thomas's, 1858.

NEW ST. THOMAS HOSPITAL 1871



The new hospital of St. Thomas's in 1871, opposite the Houses of Parliament.

ST. THOMAS HOSPITAL PROPOSAL 1865

A Salisbury Street,
Strand,
London W.
November 20. 1865.

Description of Proposed Plan
for
Ventilation and Warming
St. Thomas's Hospital.

To
Henry Currey Esq^r
Architect

Sir,

I beg to hand you herewith a description of my
proposed plan for Ventilating and Warming St. Thomas's
Hospital, and will endeavour to explain to you in as short
a space as possible its principal features.

Principle of } The principle of the apparatus will be the same as
Apparatus } the one we have adopted in several of the most-

ST. THOMAS HOSPITAL PROPOSAL 1865

Cost of annual maintenance of apparatus *I have gone minutely into the cost for maintenance of the apparatus but it must be taken into consideration that in this calculation will include the Ventilation and Warming of the Chapel, Our door Patient Waiting Room, Dispensary, Operating Theatres, Corridors, Stairs, and in general all the principal large Rooms in the Hospital. In addition to which the Hot water for the service of the Baths etc.*

*Cost for Annual Maintenance of Apparatus
Working all day and night in Winter
Night only in Summer*

		£	s	d
<i>Fuel for 200 days and nights</i>				
<i>Warming and Ventilation for heating apparatus</i>	} 210 tons @ 16/-	168	0	0
<i>Fuel for Steam Engine 24 hours</i>				
<i>365 days including service of Baths</i>	} 84 tons @ ..	77	0	0
<i>Two Stokers at 30/- per week</i>		156	0	0
<i>Sundries Repairs Oil and Wipings etc</i>		38	0	0
		£439 0 0		

Cost of Warming and Ventilation per bed per annum *The number of beds in the Hospital being 588 will shew taking into consideration the service of the Baths and Ventilation and Warming of the other Rooms, that the cost would be 1 1/8 (equivalent to 58 p) per bed per annum.*

Cost of the Apparatus *From the best of my judgement I consider that the cost of the apparatus for carrying out my proposed plan will not exceed the sum of*

£1928 . . .

This sum would include all personal supervision of the Work during the erection of the Building and supplying all the necessary apparatus, Steam Engine, Boiler, Fans, Gearing, Heating apparatus, Cast Iron Air Gratings for Escape and Inlet, Regulating Valves, Indicating Dials, etc. etc. but exclusive of all Brickwork for the foundations of Engine Rooms, Air Chambers and Flues and Channels.

General Remarks *This is in a few words the Plan, I should propose for the Ventilation and Warming of the new St Thomas's Hospital and feel confident that should you adopt it no Hospital in England will be able to compete with St Thomas's for the purity and equal temperature of the Wards, which result I will guarantee, if desired.*

*I am, Sir
Your obedient Servant*

(signed) Wilson W Phipson
=====

JOHN HOPKINS BALTIMORE 1880

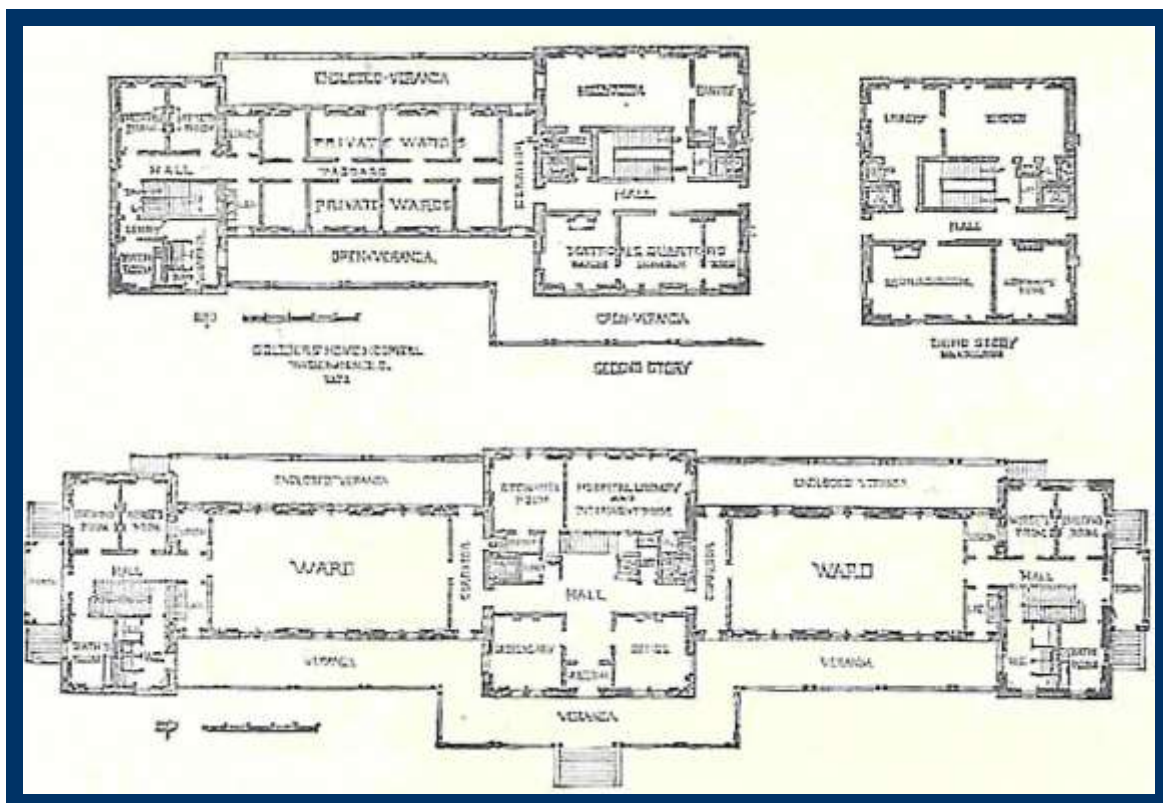
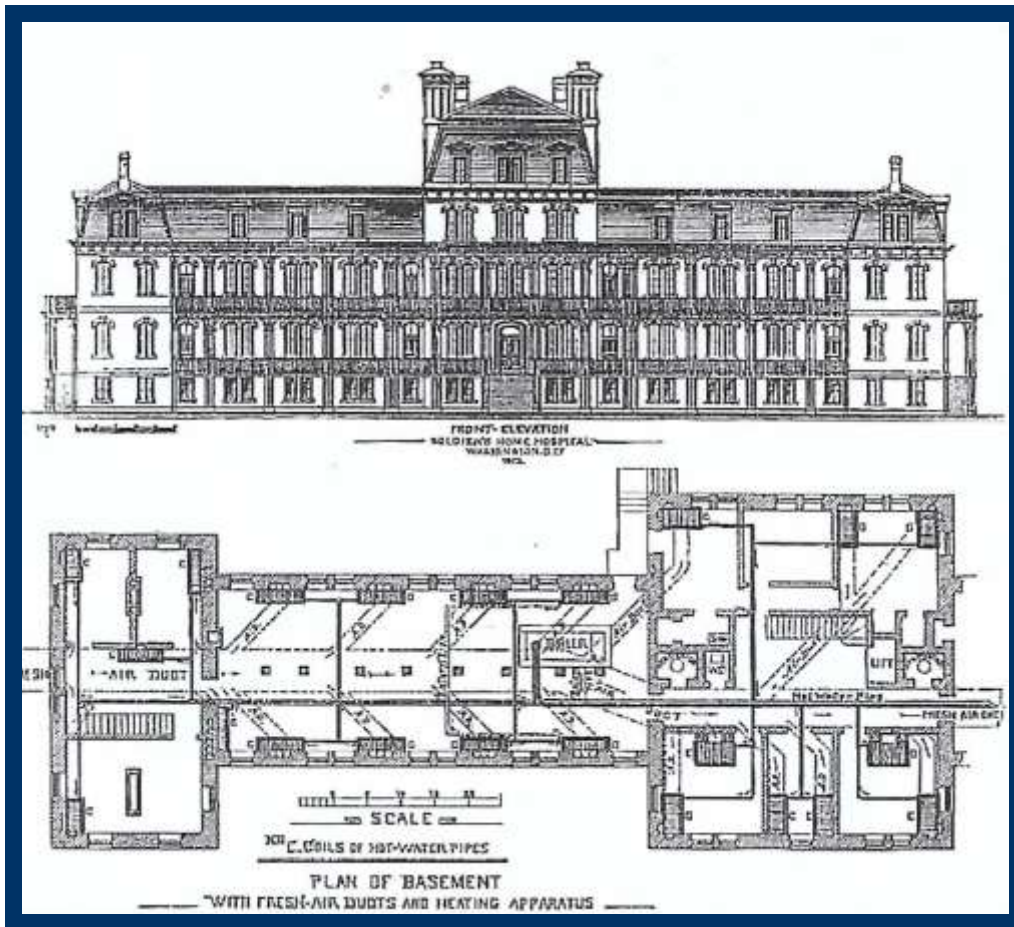


The *Isolating Ward* block, each patient having a separate room with its own ventilating system, the foul air being exhausted through the ranks of *aspirating chimneys*.



Common Ward with iron blacksmith beds, each having supply air outlet under c.1885

SOLDIERS HOME WASHINGTON DC 1883



Basement & Ward floor Plans showing mechanical ventilation and hot water heating.

ARMY HOSPITALS WASHINGTON DC 1865

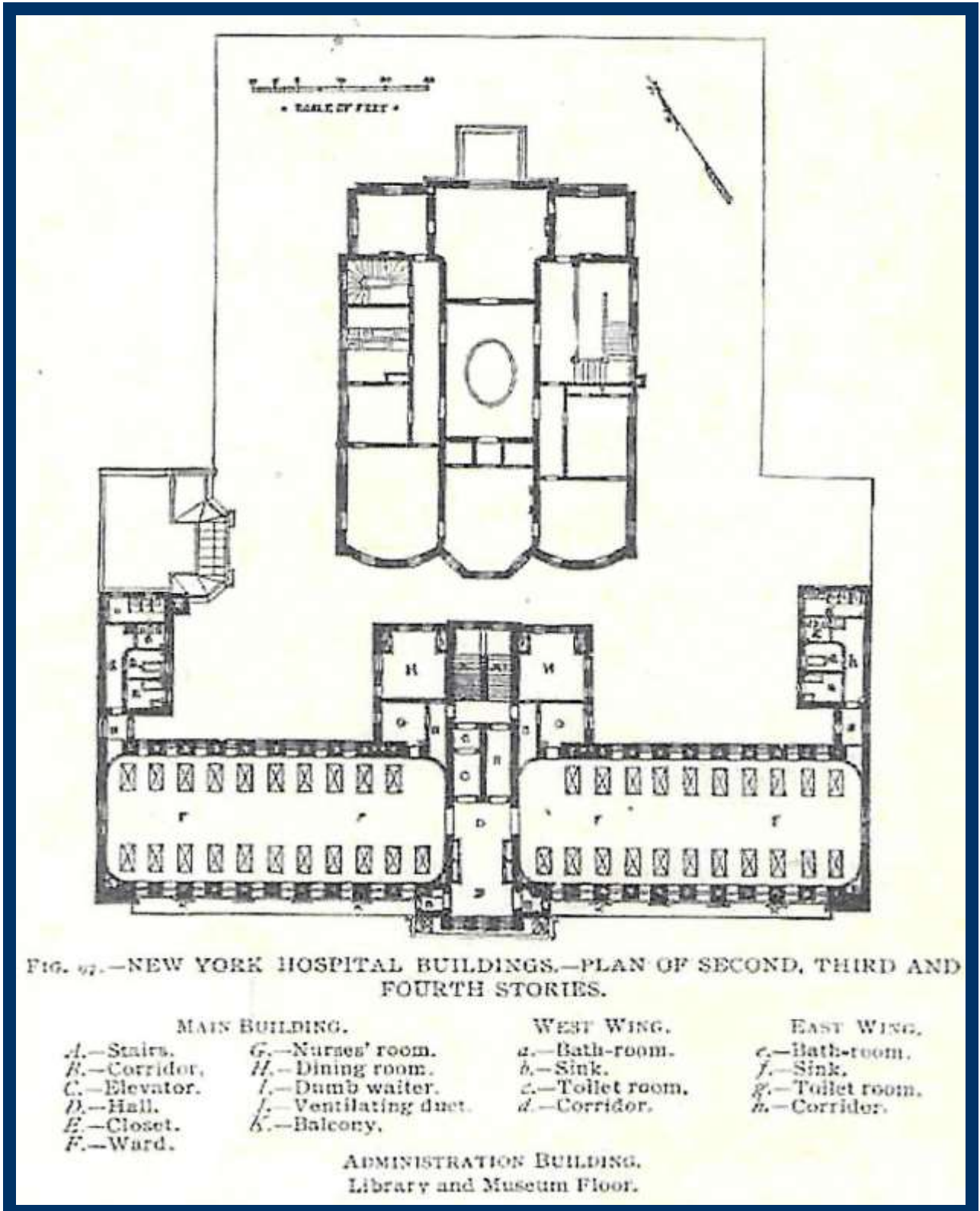


Armory Square Hospital with heating stoves behind the wheelchair patient.



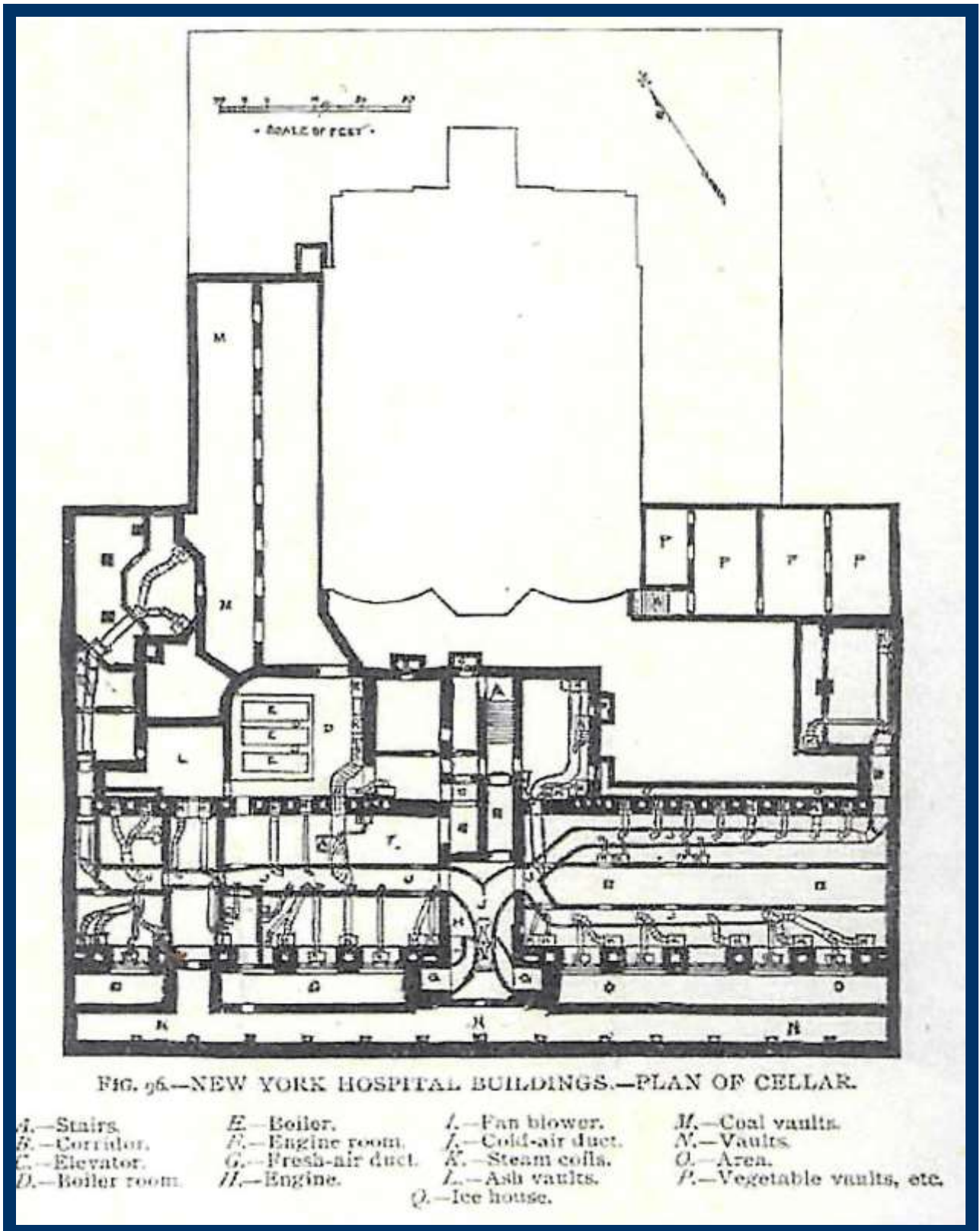
Harewood Army Hospital, solid-fuel stoves and kerosene lamp lighting.

NEW YORK HOSPITAL



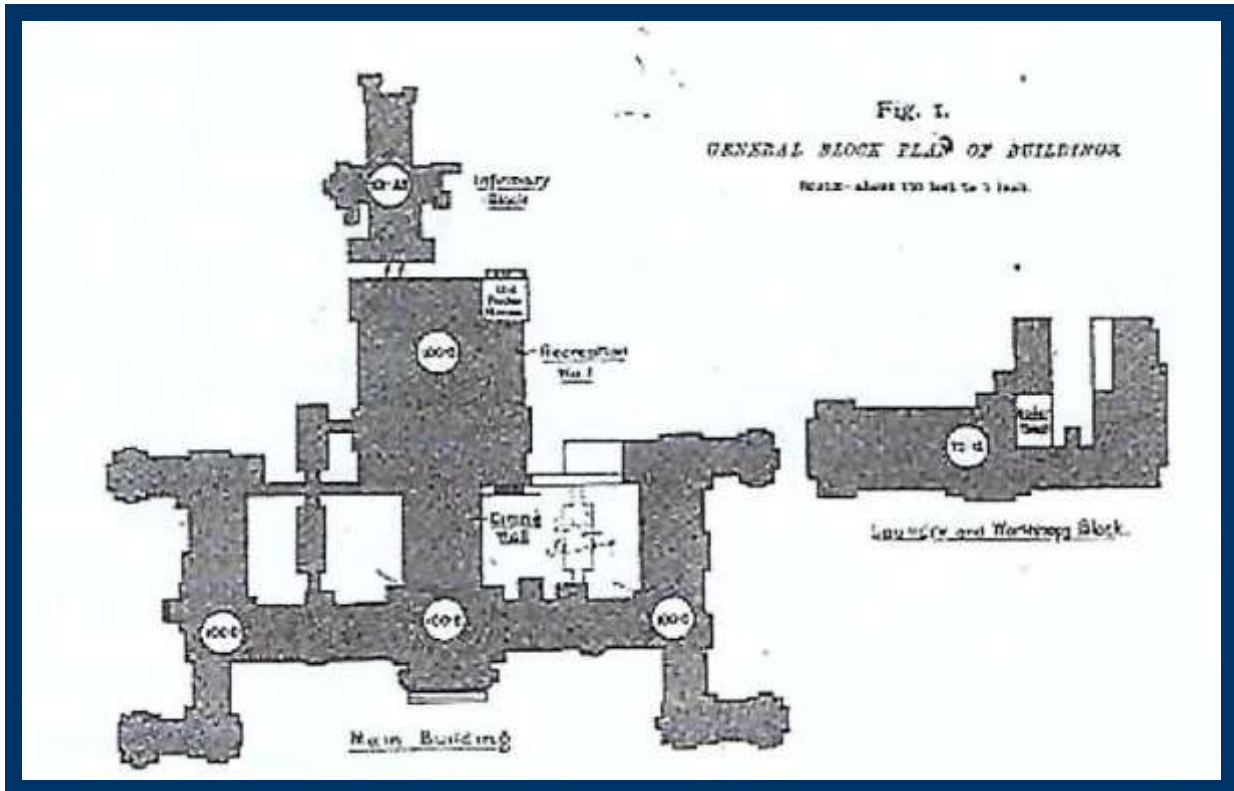
Typical Floor Plan.

NEW YORK HOSPITAL

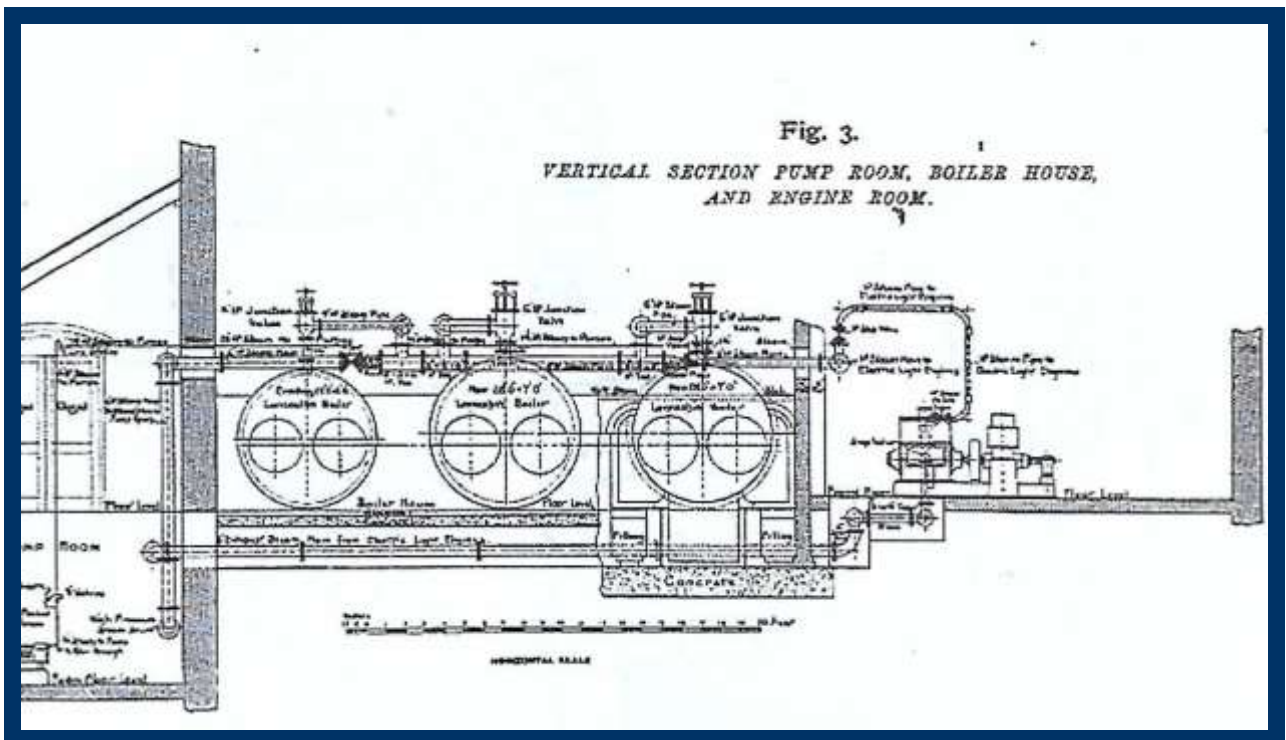


Basement Plan shows 3 boilers in the boiler room, the coal storage area and ash disposal vaults, the fresh air and cold air ducting, steam heating coils and supply fan (blower).

EARLSWOOD ASYLUM SURREY

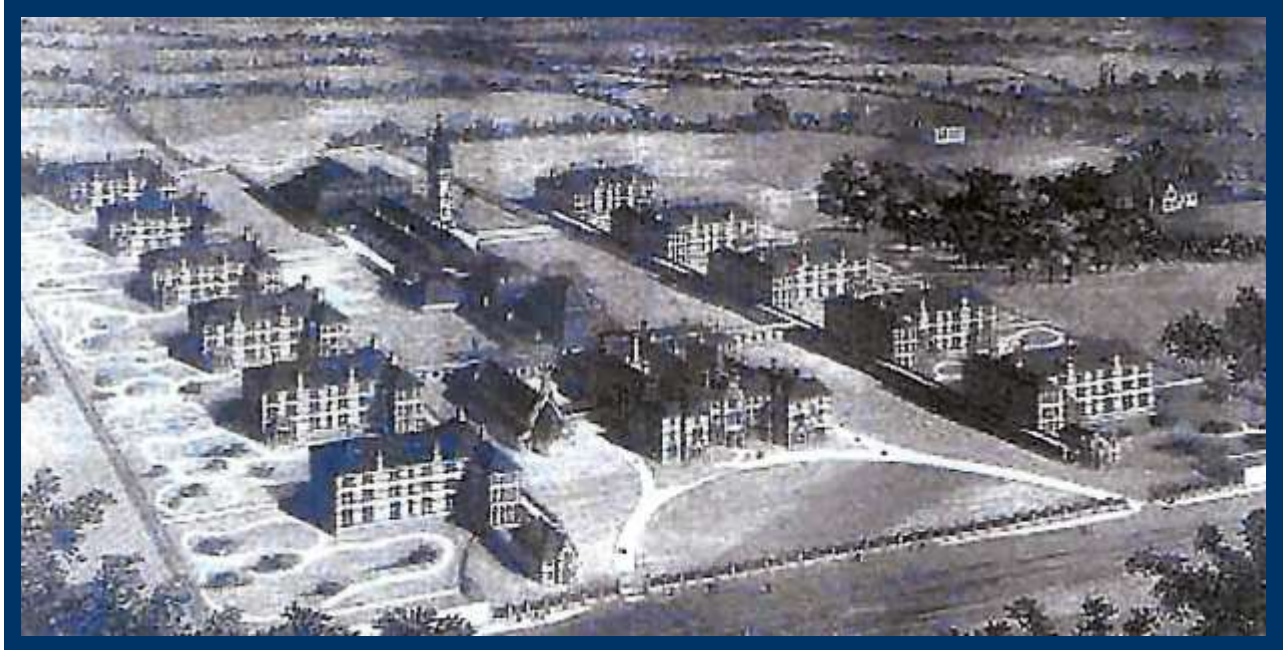


Block Plan.



Section through Boiler House showing 3 Lancashire steam boilers.

LEAVESDEN IMBECILES ASYLUM 1868



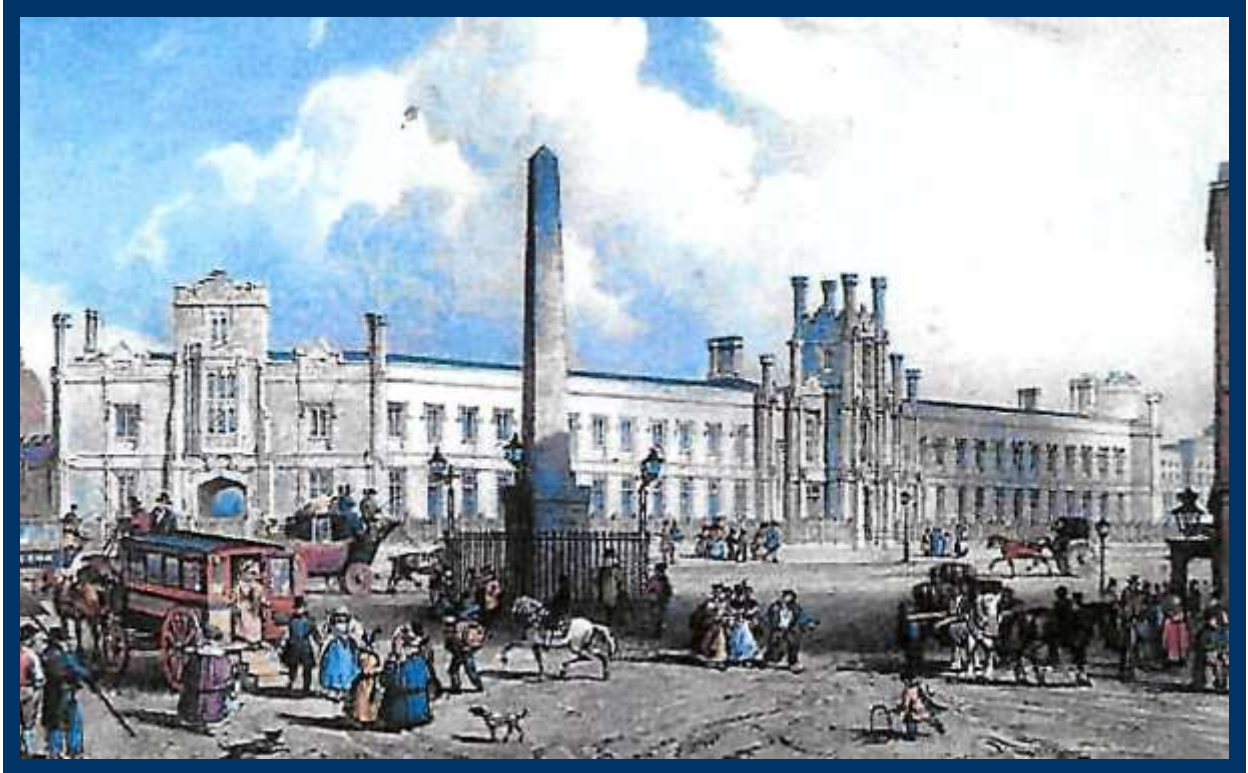
Located at Leavesden near Abbots Langley



Photograph about 1905.

The original names for this type of hospital have been retained and used in the title.
It is recognised that such a description of the patients is no longer acceptable.

INDIGENT BLIND ASYLUMS LONDON



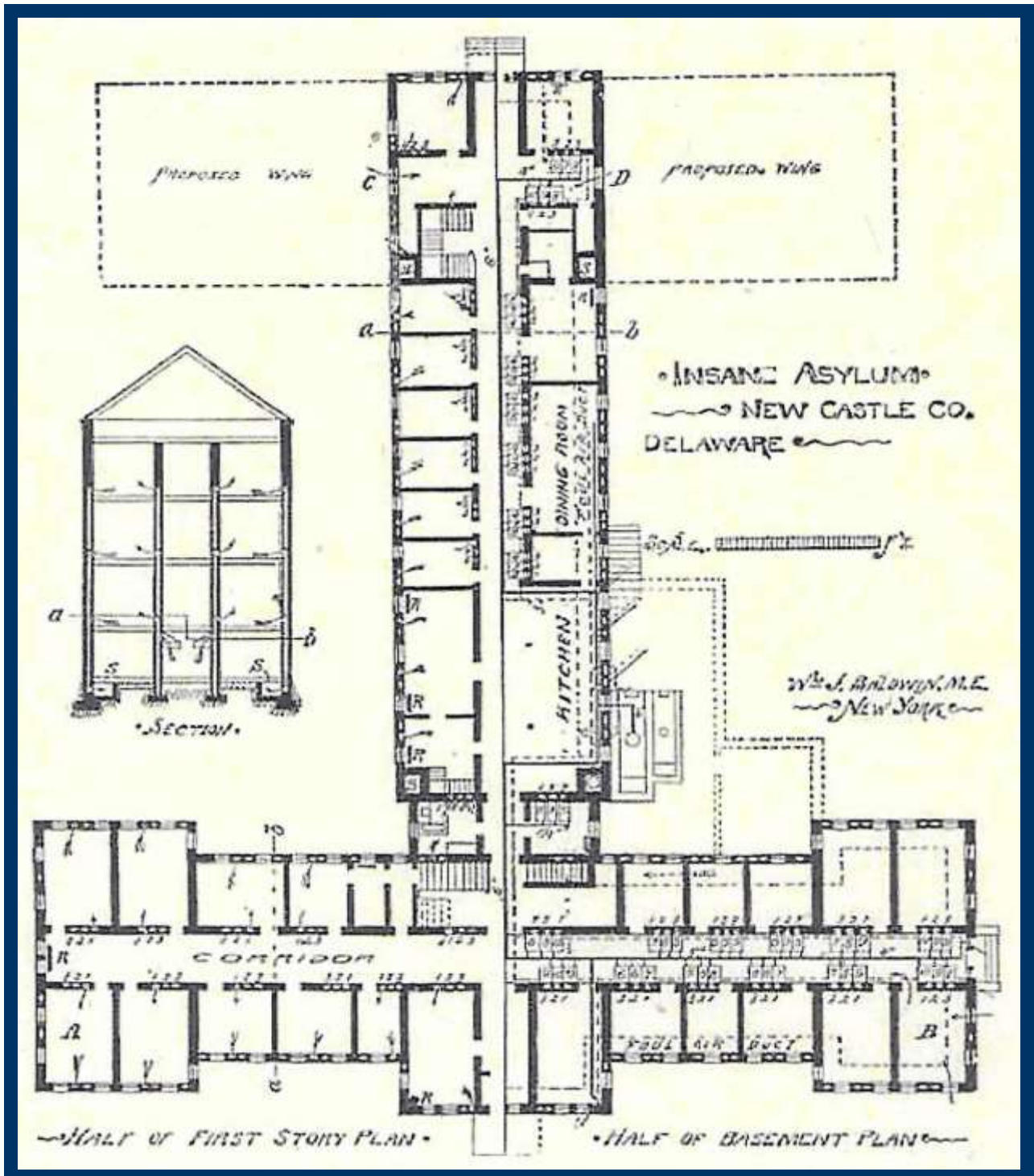
London Blind School, founded 1799. Note the chimneys.



Blind Asylum in the Westminster Road, London c.1831.

The original names for this type of hospital have been retained and used in the title. It is recognised that such a description of the patients is no longer acceptable.

INSANE ASYLUM DELAWARE 1884



Basement and First Floor Plan with Section showing ventilation airflow.

The original names for this type of hospital have been retained and used in the title. It is recognised that such a description of the patients is no longer acceptable.

KING EDWARD OPERATING THEATRE 1909



Opened in Winsor 1909, 50 beds, steel-framed building, heating by under-window radiators.



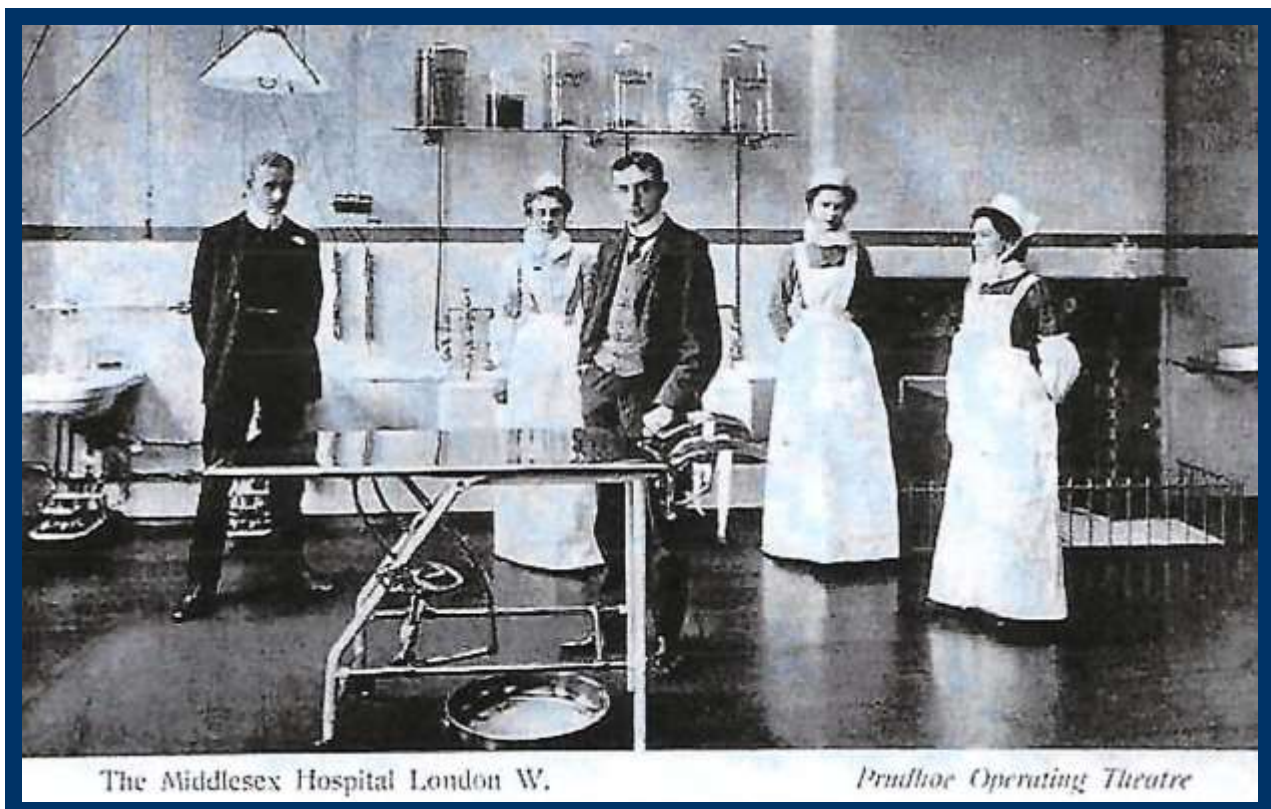
At Windsor Hospital, radiator heating (one behind seated surgeon).

BEAUFORT OPERATING THEATRE 1917



War Hospital in Bristol c.1917 with two radiators under windows.

MIDDLESEX OPERATING THEATRE 1910



Prudhoe Operating Theatre heated by open fireplace complete with fender and fireguard.

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HENLEY OPERATING THEATRE 1912



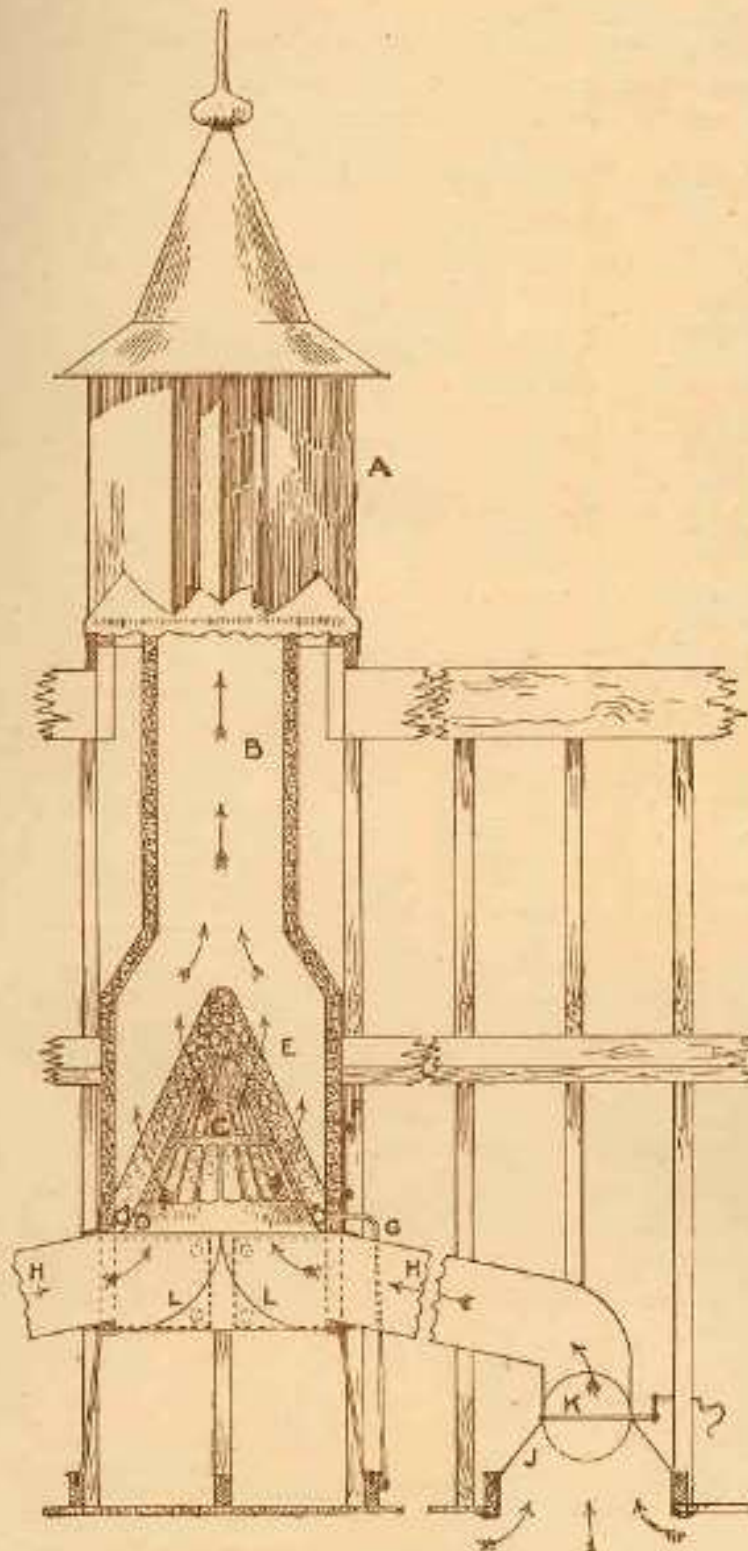
War Memorial Hospital c.1923 with 8 beds in 2 Public Wards.
Radiator under window and (on left) trolley with medical gases.

UNKNOWN OPERATING THEATRE 1905



No heating visible. Opening sash windows. Staff wearing neither masks nor gloves.

BOYLES BACTOLITE SYSTEM 1900 VENTILATION FOR DESTROYING GERMS



BOYLE'S BACTOLITE (PATENT.) FOR DESTROYING DISEASE GERMS.

The Bactolite is intended for use in small-pox and other infectious diseases hospitals. The disease germs in the air of the hospital are entirely consumed in their passage through the asbestos furnace situated in the roof and connected with the "Air-Pump" Ventilator, so that they do not pass into and contaminate the outer air, spreading infection.

With the "Boyle" system of ventilation, as applied to small-pox hospitals, the air inlets communicate direct with the outer air through specially constructed openings made in the walls fitted with self-acting valves to prevent the air of the hospital from passing by any chance out through these openings.

The incoming air is warmed in cold weather to an agreeable temperature by means of Boyle's Ventilating Radiators without the deterioration and discomfort which results when hot air heating is employed.

In warm weather the fresh air supply is cooled in its passage through the refrigerating chambers attached to the Radiators, and washed and purified by filtration through saturated and medicated screens.

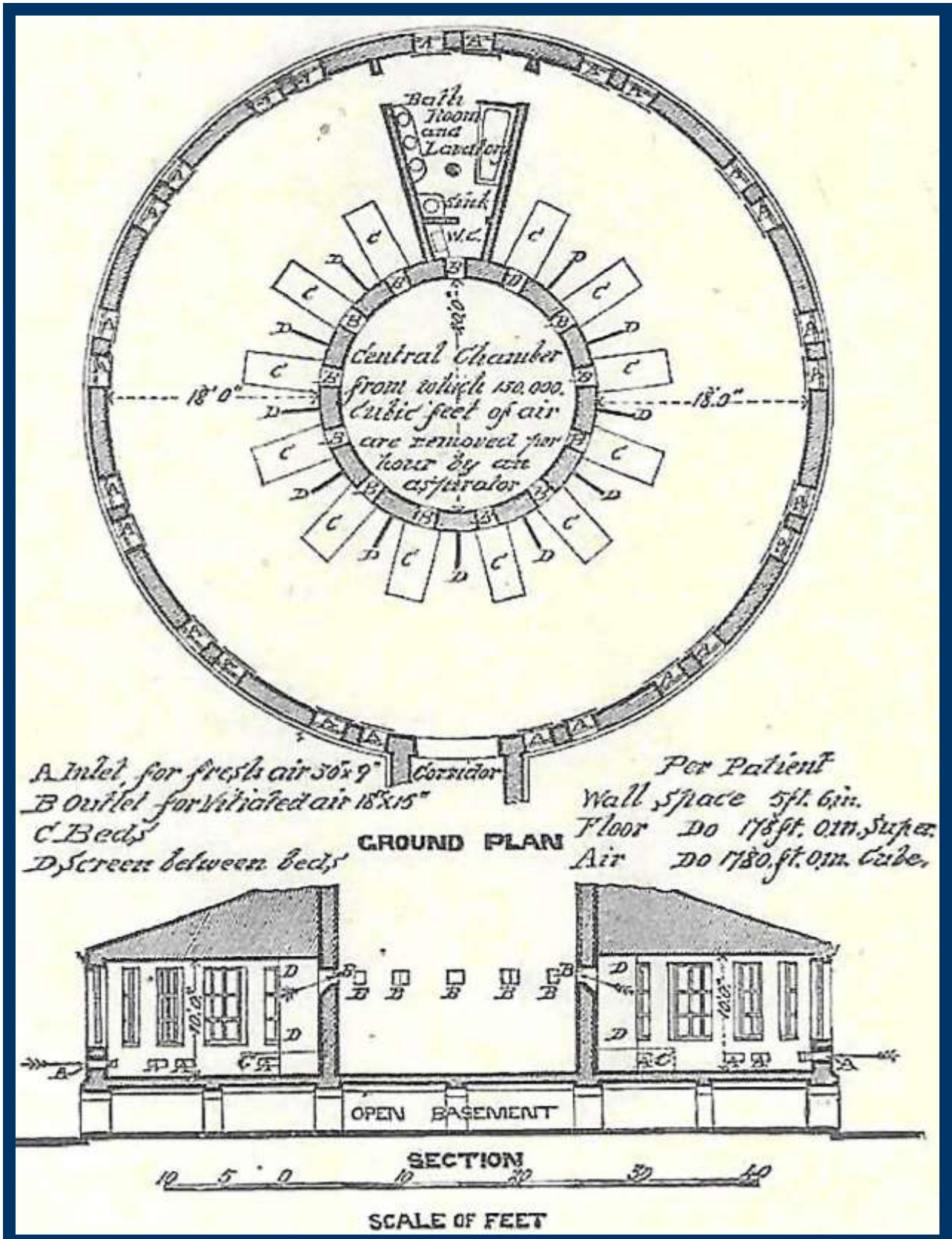
The outlets and inlets are accessible in all parts for cleansing purposes.

Description.

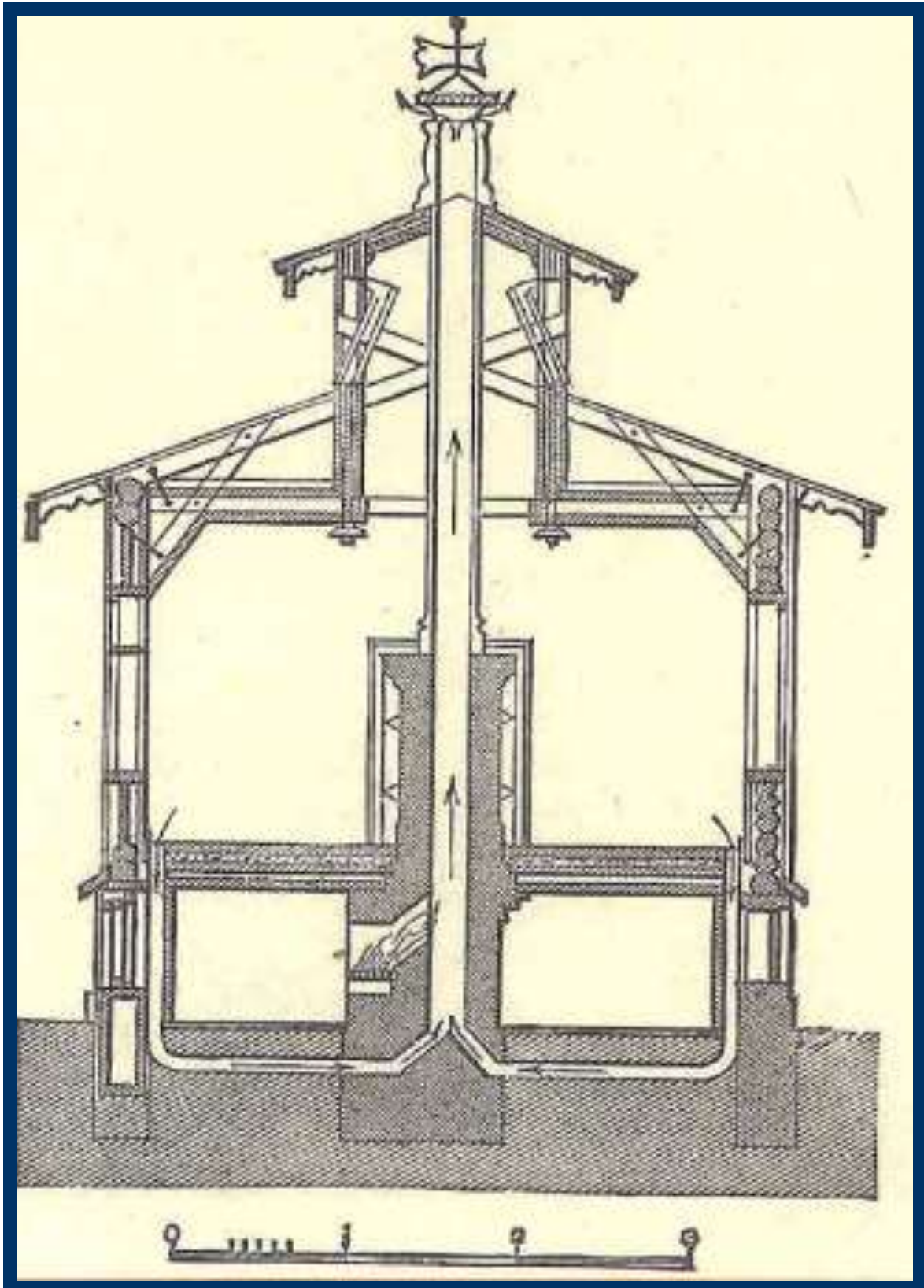
- A Boyle's Patent "Air-Pump" Ventilator made fireproof.
- B Main extraction shaft incased in larger shaft with space between packed with non-conducting material.
- C Double grill with space between filled with perforated asbestos balls, through which the disease germs pass and are consumed.
NOTE.—More than one of these double grills may, where required, be fitted one above the other.
- D Ring of atmospheric burners, the flames from which render the asbestos balls incandescent.
- E Fireproof chamber containing grills.
- F Door giving access to chamber for lighting and other purposes.
- G Gas pipe.
- HH Branch extraction shafts connected with openings in ceiling.
- J Cone covering opening in ceiling.
- K Weighted regulating valve.
- LL Doors giving access to extraction shafts for cleansing purposes.

Estimates Given.

SANDERSONS CIRCULAR WARD 1880 MECHANICAL VENTILATION

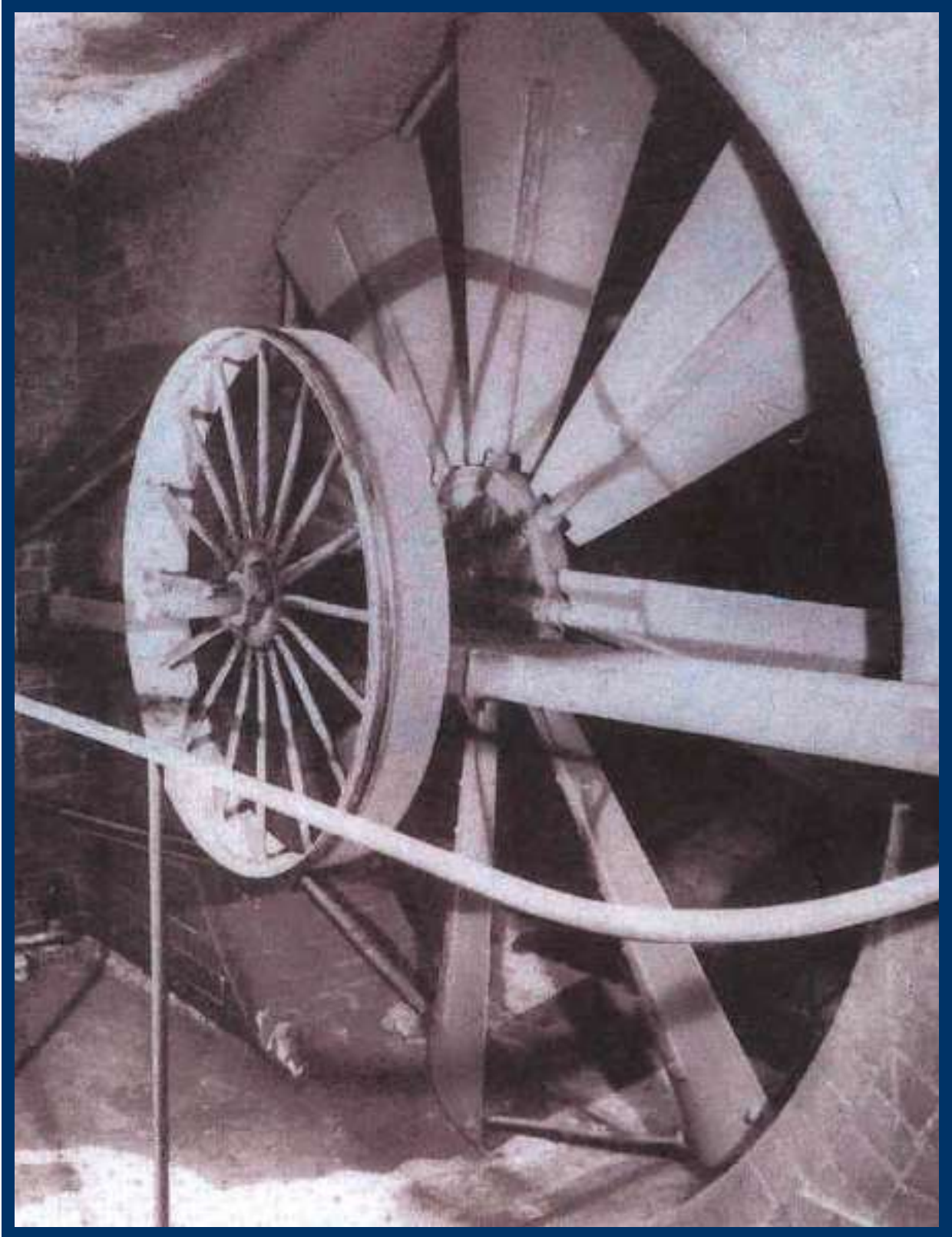


ST. PETERSBURGH HOSPITAL RUSSIA 1876 HEAT ASSISTED HOSPITAL VENTILATION



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BIRMINGHAM GENERAL HOSPITAL 1893 MECHANICAL PLENUM VENTILATION



The 8 ft diameter Blackman ventilating fan.

LEWISHAM HOSPITAL KITCHEN 1912



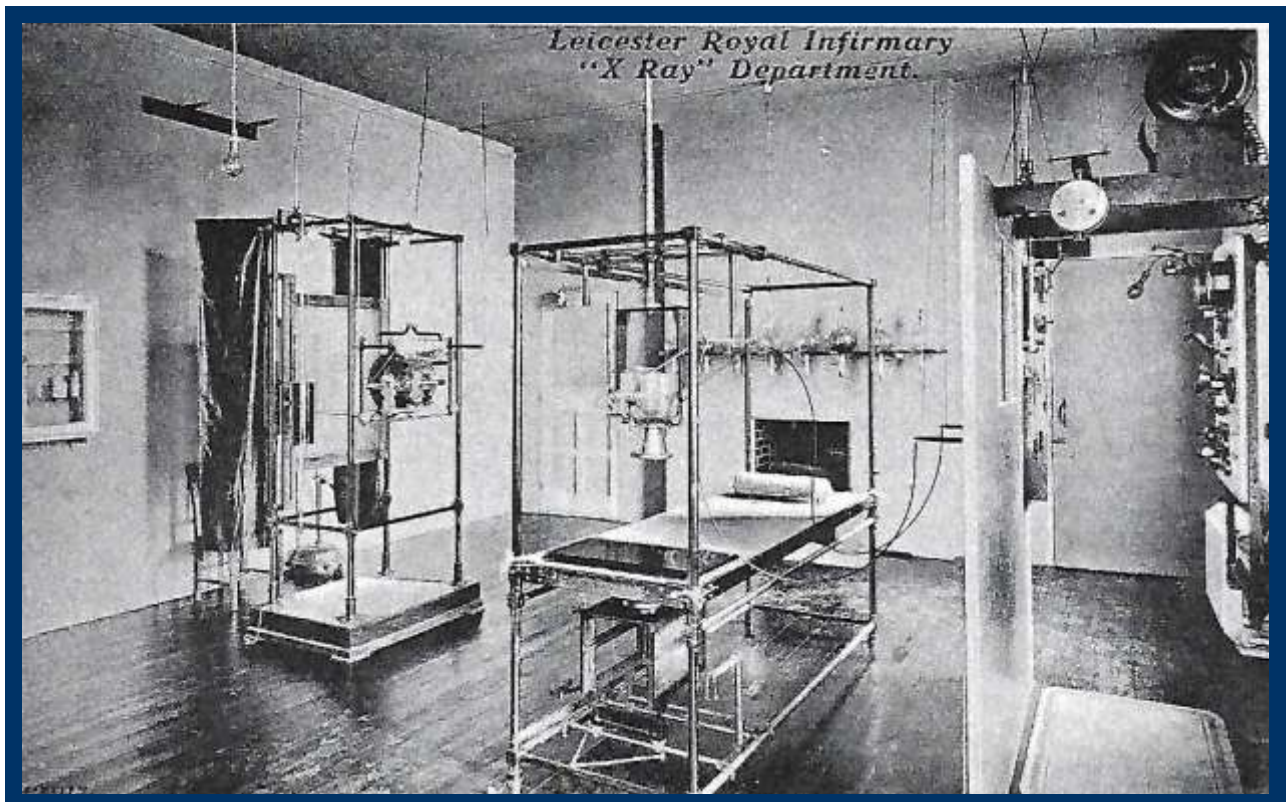
HARROGATE HOSPITAL KITCHEN 1910



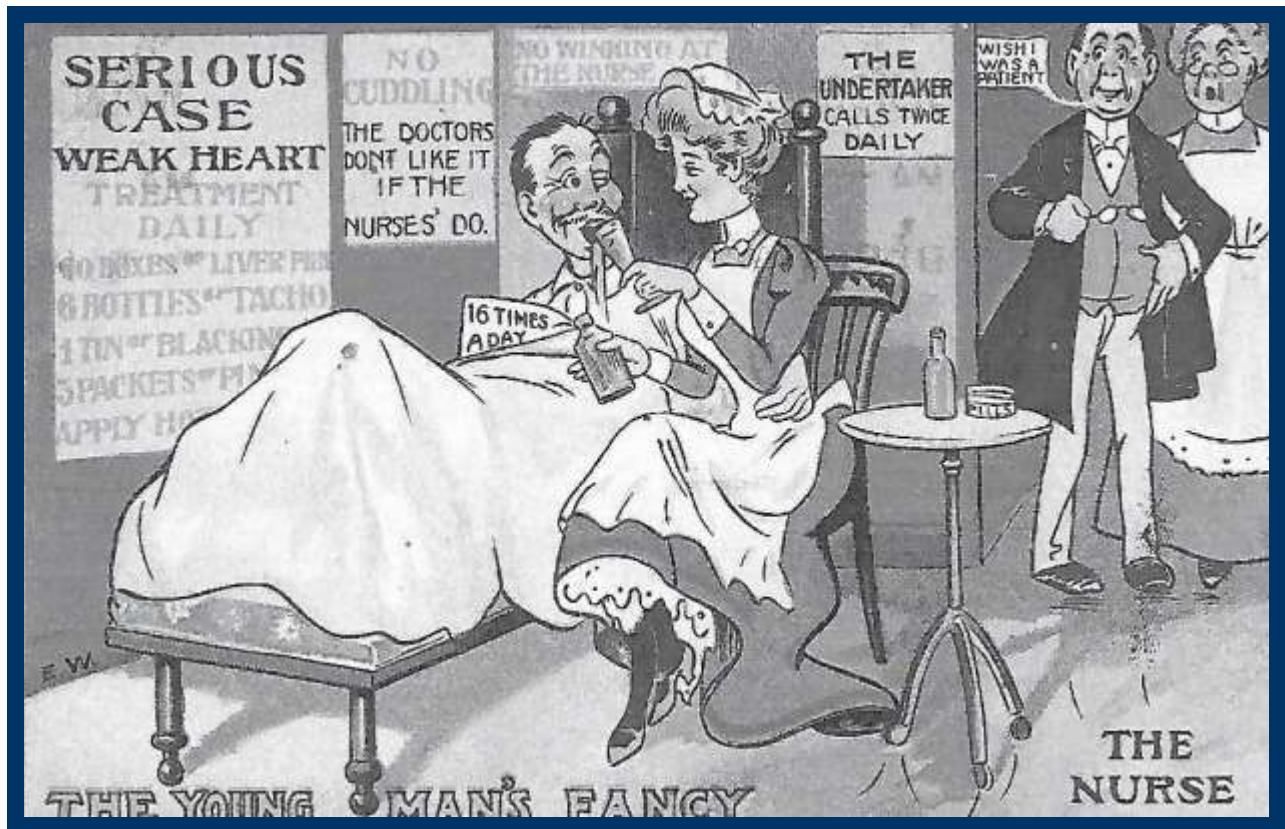
ALEXANDRA RHYL LAUNDRY 1908



LEICESTER HOSPITAL X-RAY DEPT. 1905



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