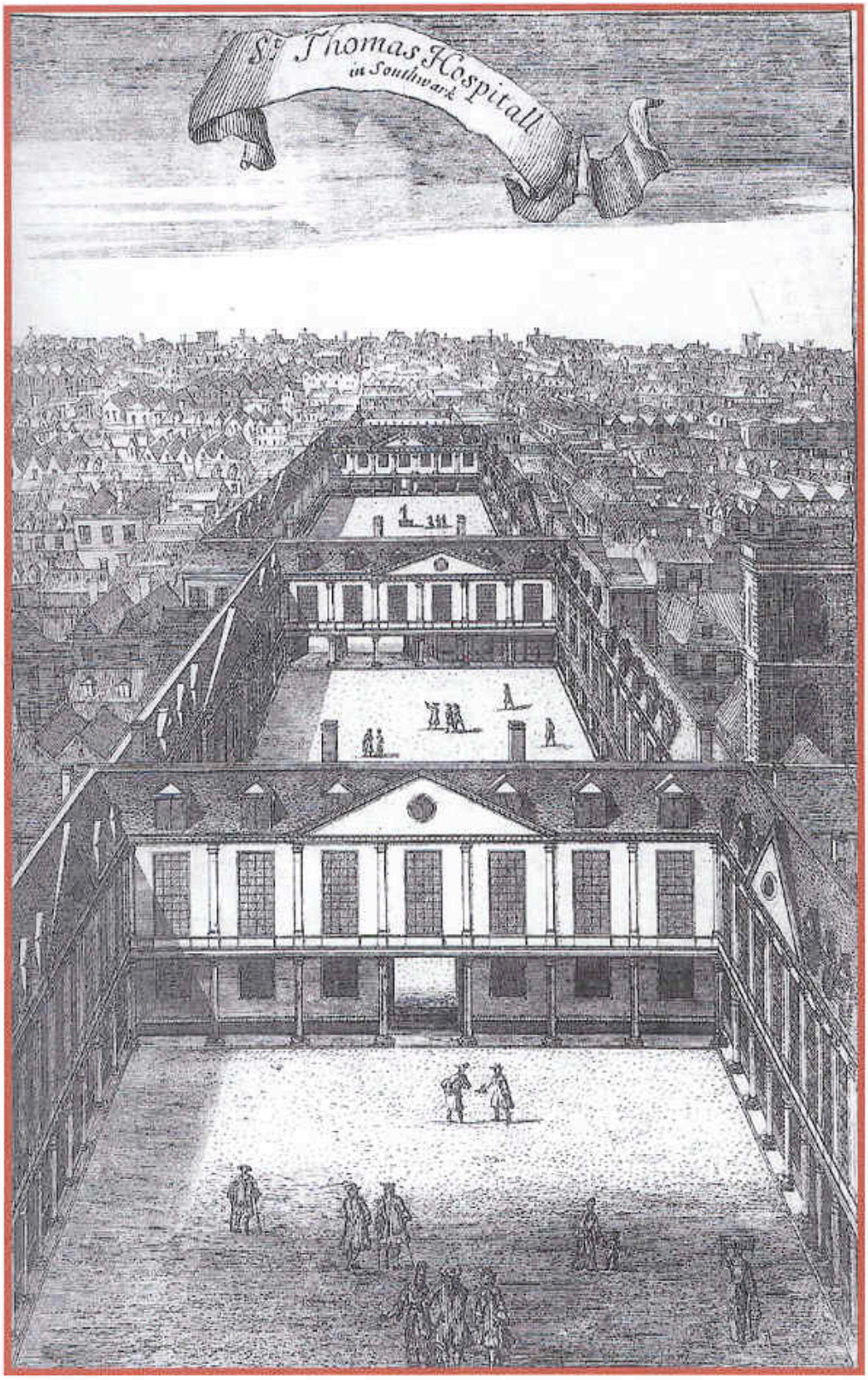
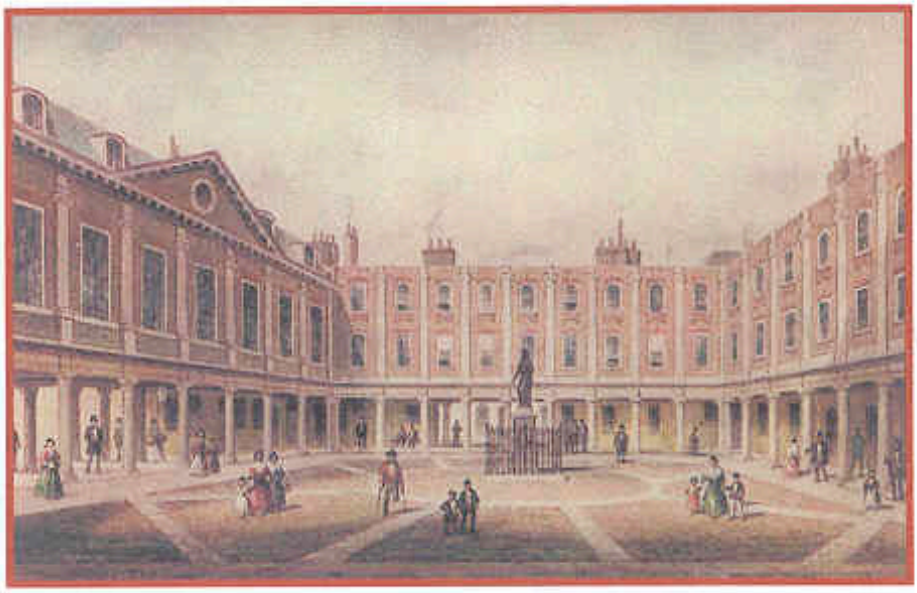
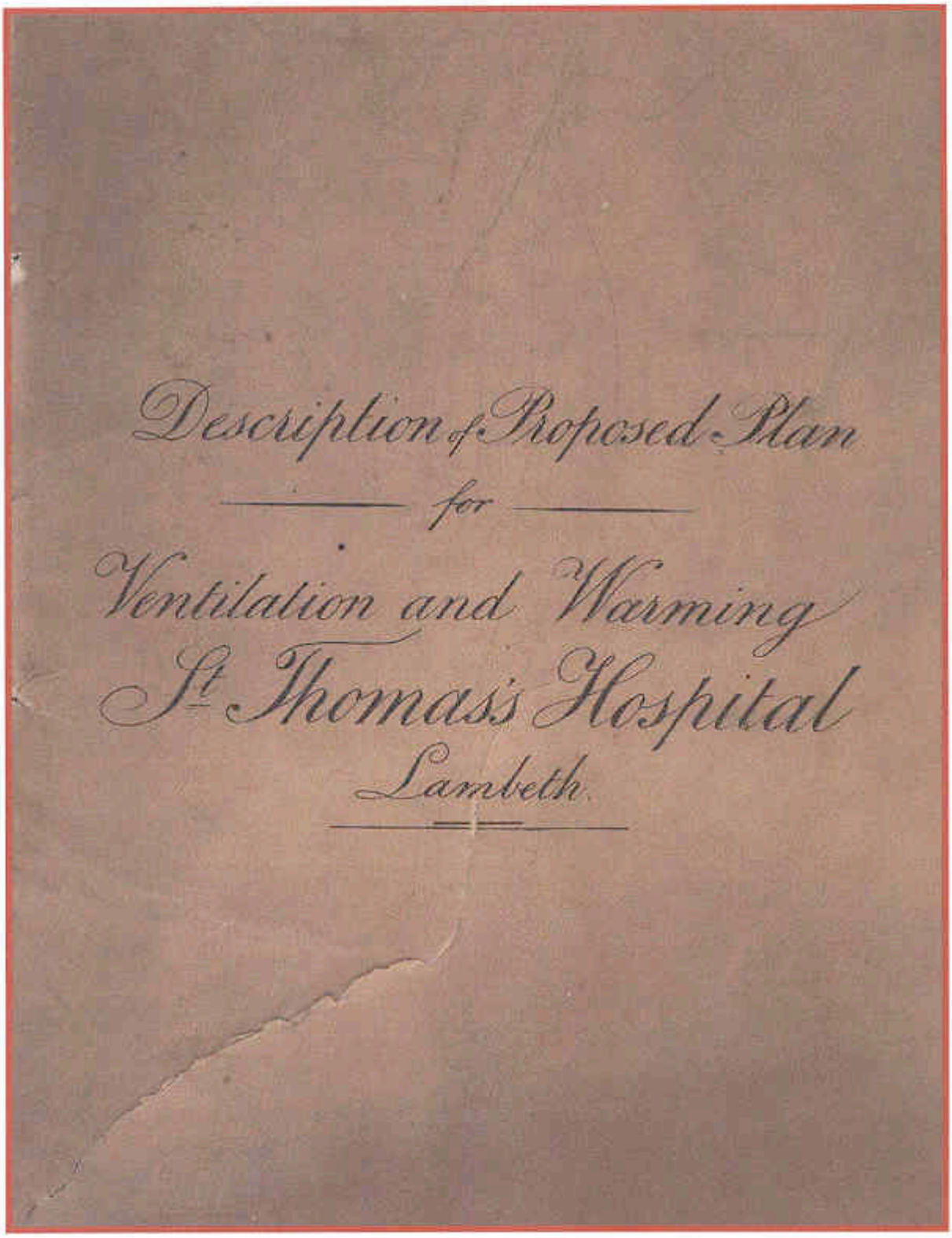
# ST THOMAS'S HOSPITAL, LONDON




**St Thomas's as it was rebuilt between 1693 and 1709 on the original site in Southwark [EH, fig.10]**



**[Top] Quadrangle of St Thomas's, 1858 [BH, opp.p18]. T H Shepherd water colour.**
**[Bottom] The new hospital of 1871 opposite the Houses of Parliament**




**Cover of the document submitted by the engineer, W W Phipson, to the architect Henry Currey detailing proposals for Ventilation & Warming, 20 November 1865 No reply has so far been discovered and the proposal was not adopted. [CIBSE Heritage Group Collection].**

ST THOMAS-S

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

# Description of Proposed Plan

for

# Ventilation and Warming

# St. Thomas's Hospital.

To
Henry Currey Esqre
Architect

Sir,

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

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

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**Opening page of the document submitted by the engineer, W W Phipson detailing proposals for Ventilation & Warming, 20 November 1865. [CIBSE Heritage Group Collection].**

## PART-3 PHIPSON'S WORKS: CASE STUDIES

### 3.1 St Thomas's Hospital, Lambeth Palace Road,Lambeth, London, 1871
### Phipson's Proposal of 1865
### Architect Henry Currey

Phipson made a proposal (handwritten by a clerk in immaculate copperplate style and bound into a folder] with green ribbon) entitled "Description of Proposed Plan for Ventilation and Warming St Thomas's Hospital." [PC/49, 20 November 1865] This described the "Principle of the Apparatus" as used by Van Hecke in various new continental hospitals and other buildings. (These are listed at the beginning of Part-2.) The proposals described the steam engine driven fans, the "warming apparatus", the proposed distribution of the air, the method of temperature regulation, and quoted the annual cost of maintenance (£439.00 per annum) and gave an estimate of the capital cost (£1928.00). The plans referred to have not been located. This is Phipson's submission:

*1 Salisbury Street*
*Strand,*
*London.W.*
*November 20. 1865*

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

*To*
*Henry Currey Esq*
*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 Apparatus*

*The principle of the apparatus will be the same as the one we have adopted in several of the most important new Hospitals ("Necker, Beaujon, Vesinet, St Antoine, Croix Rouge" etc.) in Paris and other Continental Towns, and acknowledged by all the competent authorities as fulfilling at once the necessary conditions of an uniform temperature combined with the desired renewal of the air, so as to ensure at all times an agreeable, and healthy atmosphere in all the Wards the whole constituting a simple and economical application.*

*It must be taken into consideration that the plan I now submit will work as well simultaneously with any natural appliances as without, and I am far from those who advocate closing Windows etc. to ensure a result as the succefses of our applications are owing to a judicious utilization of the natural Laws of Ventilation aided when required by mechanical power.*

*Description of Apparatus*

*The Plans I herewith submit numbered 1 to 5 will give you the general features of my proposed plan, reserving the details of the application to a personal explanation for which I hold myself at your disposal to give it when desired. The description of which is as follows.*

*In the centre Building, in Basement I propose fixing a small Four Horse Power Steam Engine working two Fans, drawing the fresh air from the exterior of the Building, thro' the Air Shaft and by means of an underground air channel to convey this cold air forced along by the Fans to the different Air chambers, each block having its distinct chamber placed near the Stairs, as shewn on plans -one Fan propelling the Air to the chambers in the right Blocks, the other to the Chambers in the left Blocks.*

*Warming Apparatus*

*In these Air Chambers or Reservoirs will be fixed in each a Warming Apparatus of simple construction. These Warming Apparatus maintain the Air Chambers at the thermometrical degree necessary to ensure by the flow of air from them a proper temperature of 60° Fahrenheit in the Wards.*

*Distribution off the Air*

*The distribution of air from these Chambers to the different Wards etc. will be by means of air channels; the Warm air in Winter and cold air in Summer entering each Ward as shewn on Section No.5, the air gratings for inlet being placed in the skirting.*

*The size of the openings being each equal to 126 square inches, will at the moderate velocity of two feet per second deliver 7200 cube feet of air through each Grating per hour or 72000 cube feet for the Ward equal to 3500 cube feet per hour per patient.*

*The amount of Air supplied to be regulated according to the requirements, and by its moderate velocity will cause no perceptible current.*

*Regulating Valves*

*As may be easily understood the amount of air supplied from the Fans to these Air Chambers or Reservoirs may be regulated at will, and the temperatures maintained in the chambers by the Warming apparatus regulated according to the requirements, the great succefs in these applications being to ensure a large volume of air to each Ward delivered at a moderate velocity and at a low temperature having at all times the requisite amount of moisture in the air.*

*Escape of the Vitiated Air*

*For the escape of the Vitiated air, besides the means provided by you round the smoke flue from Fire places in Wards, I propose having in addition separate Escape flues built into the Walls as shewn on plans, collected in three distinct chambers in the Roof the escape of same being round the Chimney Stacks. By constructing the last length of smoke flues in iron before it reaches the Stack, I shall ensure by the heat generated by them a powerful up current in the Escape flues.*

*The Escape Flues can also be arranged so as to be carried into the Shaft provided near Stairs.*

*Position of the Opening*

*The openings for the Escape of the Vitiated Air will be equally distributed, and the Air taken away from the highest level.*

*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 |
|---|---|---|
| *Fuel for 200 days and nights Warming and Ventilation for heating apparatus* | *210 tons @ 16/-* | *168 0 0* |
| *Fuel for Steam Engine 24 hours 365 days including service of Baths* | *84 tons @ ,,* | *77 0 0* |
| *Two Stokers at 30/- per week* | | *156 0 0* |
| *Sundries Repairs Oil and Wipings etc* | | *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 11/8 (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 necefsary 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*

*26. St Thomas's Hospital, Lambeth, opposite the Houses of Parliament, opened 1871 [ EH, 31]*

Phipson prepared this document at a time when he was just starting to achieve some recognition in his chosen profession of heating and ventilating engineer. In his proposal to Currey, he listed those buildings on the Continent which employed the Van Hecke system. He also referred to his own recent installations in England, namely Rothschild's Bank, the National Provincial Bank of England, and the Strand Music Hall, all in London; the Exchange Buildings, the Orphanage at Erdington, and a Masonic Hall & Club, all in Birmingham.

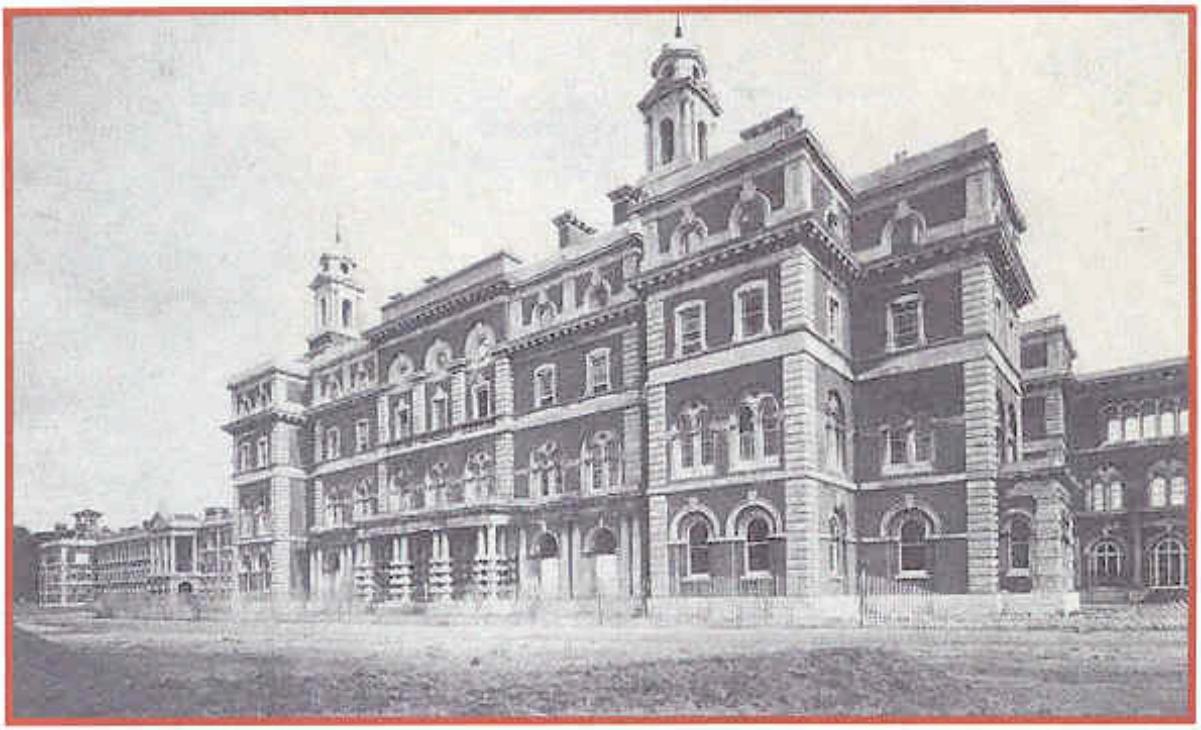
It is interesting to note, in the St Thomas's proposal, the emphasis put on Operating & Maintenance Costs. There is no further reference to St Thomas's in any of Phipson's later correspondence. Since he actively solicited testimonials from clients and took great care to advise potential clients of his successfully completed projects it is evident that his proposals were not taken up. Currey's response (if any) is unknown, and he went on to produce a design for *"588 patients in 8 detached blocks overlooking the Thames opposite the Palace of Westminster. Designed in the then fashionable Italianate style, the six central buildings, were arranged in a pavilion layout, linked by corridors."* This arrangement was due to the insistence of Florence Nightingale on the importance of free circulation of air and the isolation of patients from each other. [FN, chap. 7]

The Hospital was opened by Queen Victoria (June 1871). It was later reported in *The Illustrated London News:*

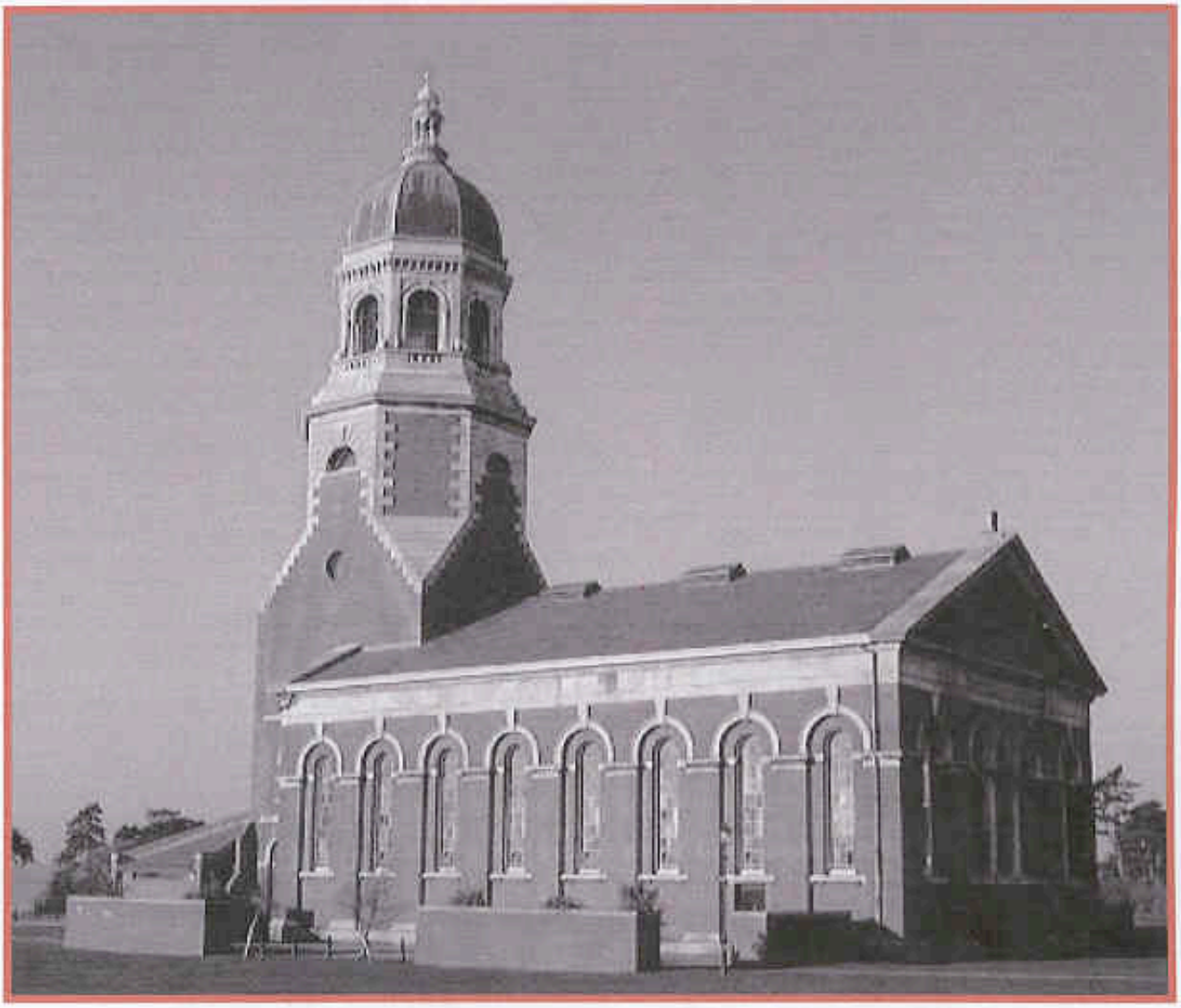
> *"Every ward on each floor has two hydraulic lifts, one small lift for food or medicines, one larger for taking up patients or nurses. Every ward too has its own bathrooms, lavatories and closets detached from others and its separate shoots for sending down dust and ashes..... dressings and other things. Natural ventilation is as much as possible depended on, with very simple auxiliary arrangements for cold nights.....All the building is fireproof..."* [SHVB, 149]

The reference to ashes indicates the use of open fires or stoves. A further write-up [TB.1871/486-7] fails to mention the heating or ventilation. Another report states, *"Heating was augmented by a warm-air system and natural ventilation was encouraged by open fires."* [VA, 232] Whether Phipson's report had any influence on the final design is unknown.

# ROYAL VICTORIA MILITARY HOSPITAL, NETLEY



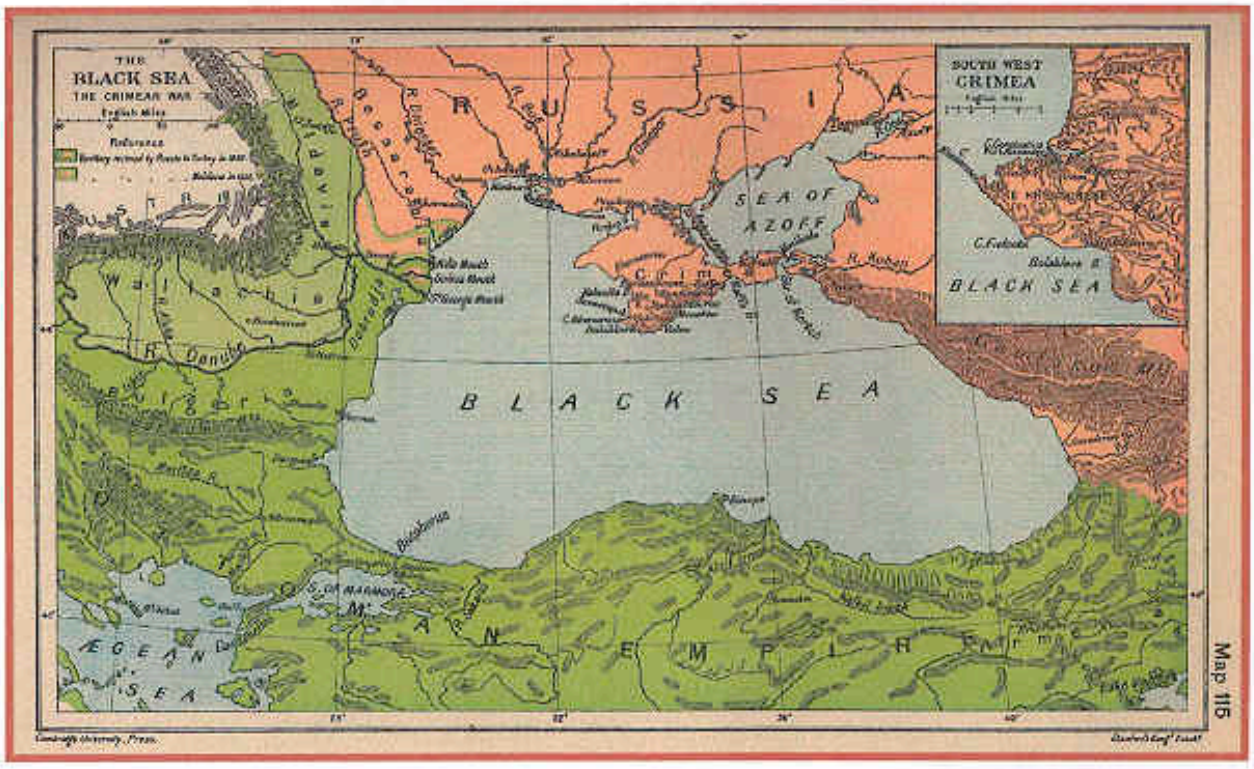
**[Top] Queen Victoria visiting the hospital in 1863.**
**[*The Illustrated London News*, 1887].**
**[Bottom] Netley, built 1856-63 [HBT, 155]**



**The imposing chapel, the only remaining building of the hospital.**

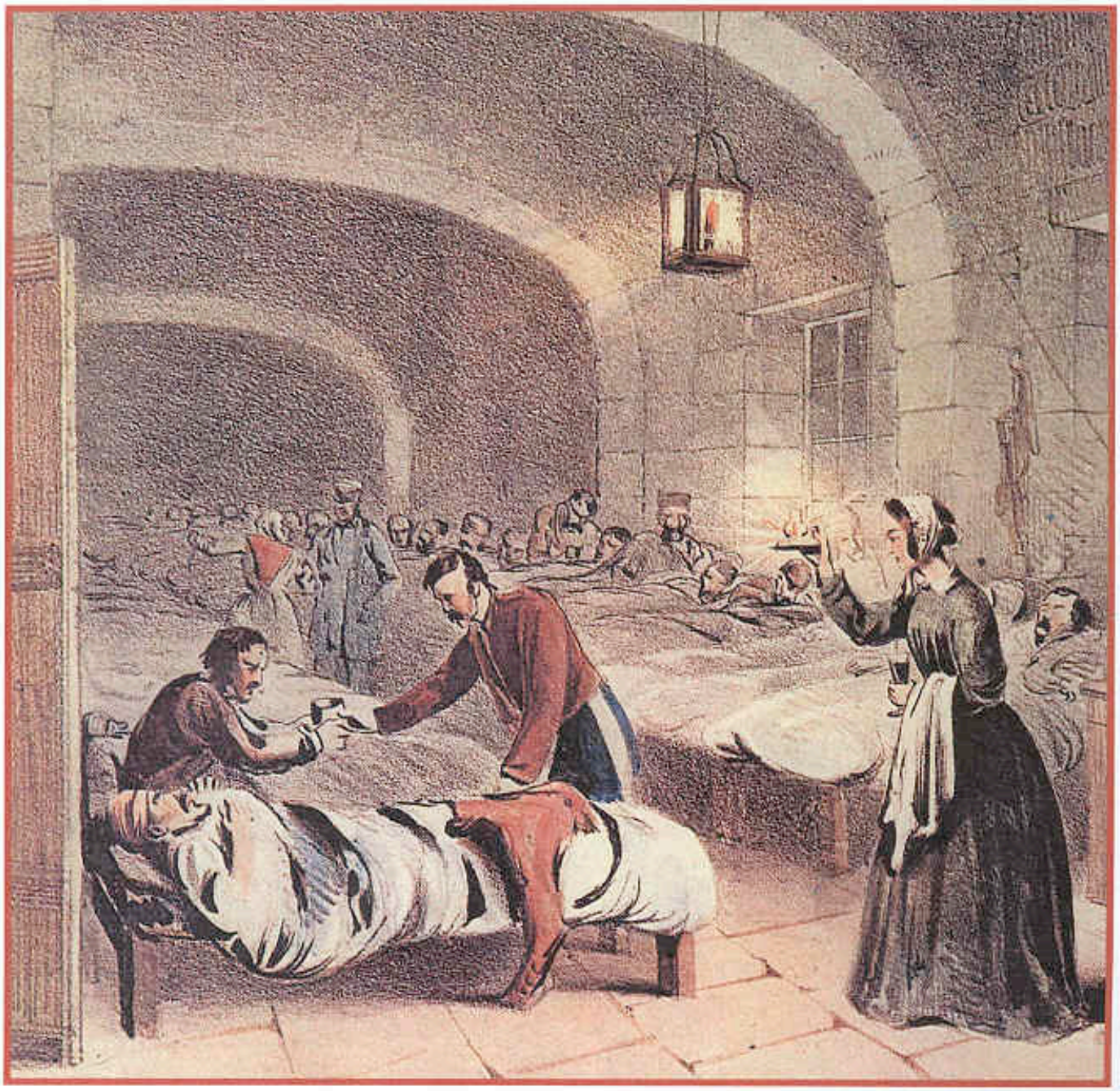
**Royal Victoria Military Hospital, Netley, c.1900, with patients from the Boer War. Note the large box-end tubular radiator (right foreground).**

# SCUTARI HOSPITAL, CRIMEA WAR




**[Top] Florence Nightingale at the entrance to Scutari Hospital mid-1850s Detail from the painting by J Barrett [FN, 66].**
**[Bottom] Map of the Black Sea and the Crimean War area. Scutari hospital was on the eastern side of the Bosphorus.**

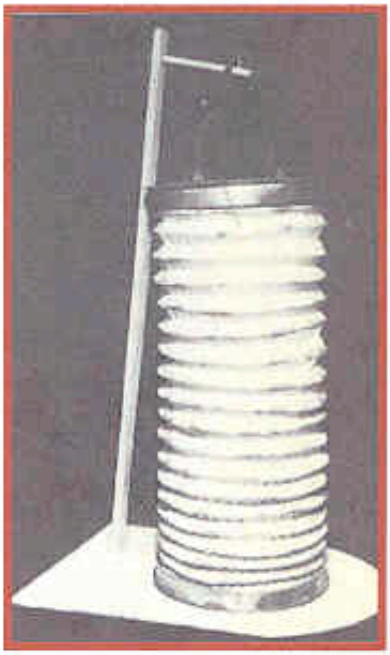
# SCUTARI



**Hospital ward at Scutari sketched by Benwell [FN, 68]**
**Florence Nightingale's lamp is thought to be incorrect. It is now believed that she used a so-called *Turkish* lamp which contained a candle within a circular collapsible shade (a pleated vertical cylinder)**

# SCUTARI

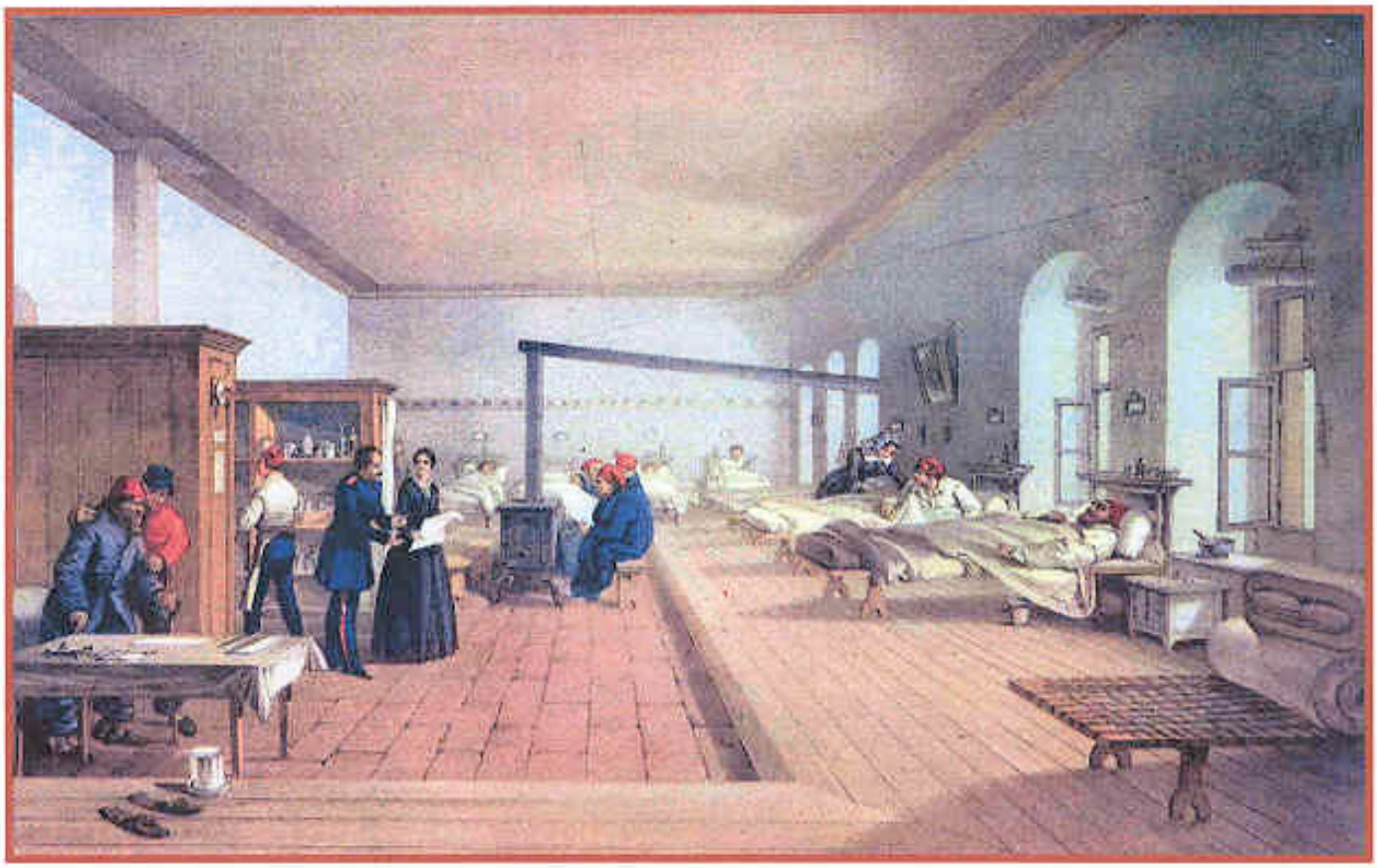
Florence Nightingale [FN, 82]



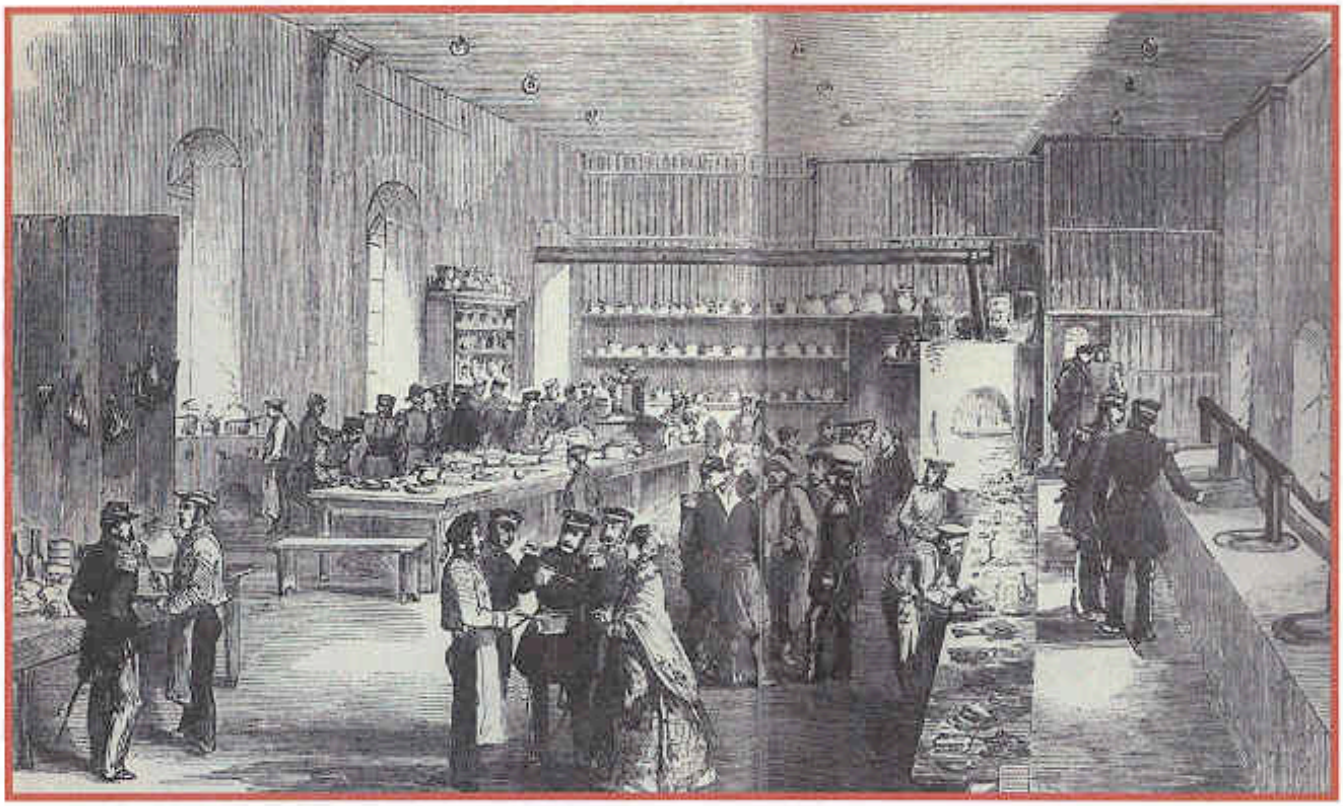
Her *Turkish* lamp [FN, 89]

**The Turkish barracks at Scutari which was turned into a British Military Hospital**
**Drawing by William Simpson, probably mid-1850s [FN, 63]**

# SCUTARI

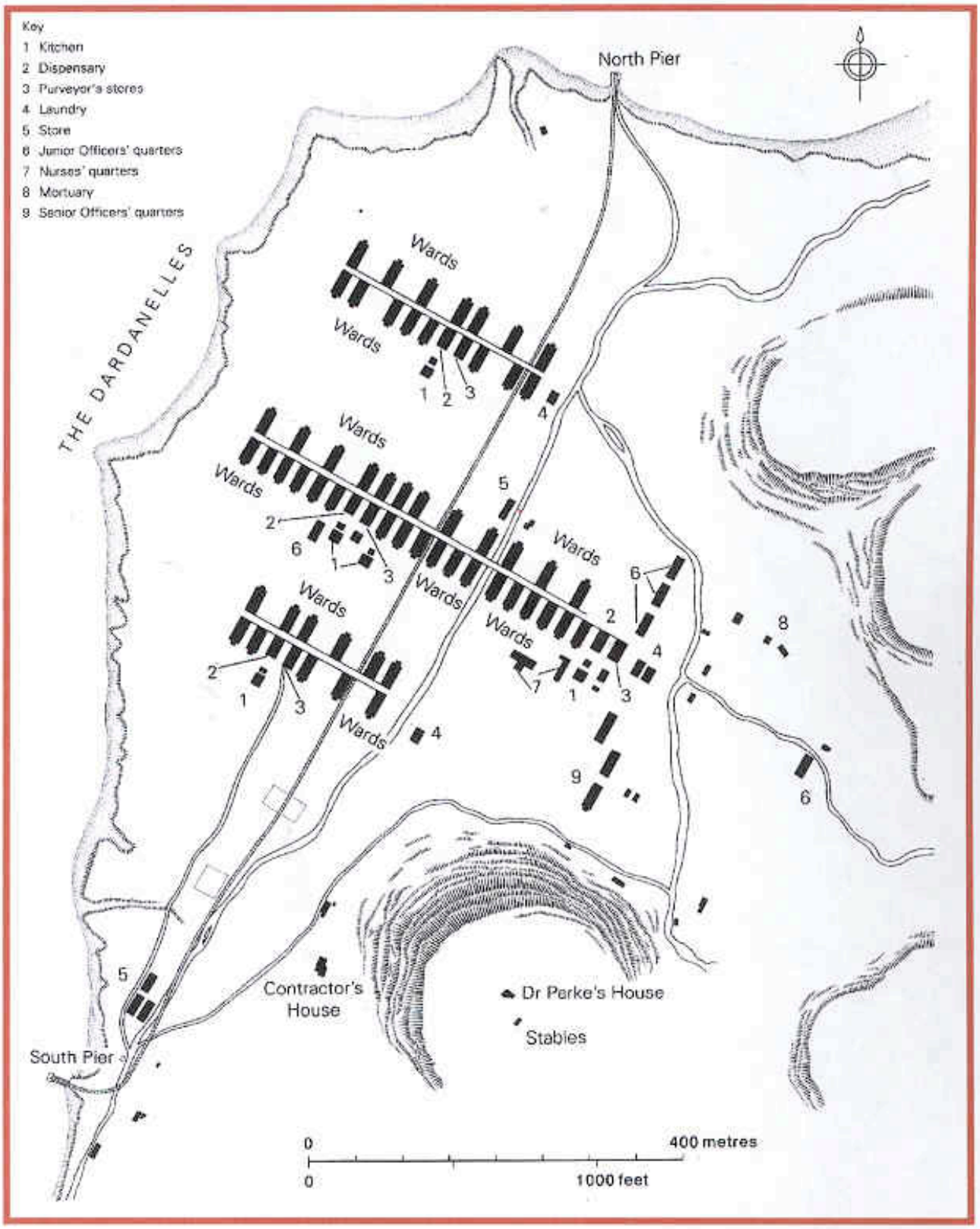


**Florence Nightingale inspecting a ward at Scutari [ESS, 32]**
**Coloured lithograph by E Walker after W Simpson, 1856.**
**Note the heating stove with its nearly horizontal flue running downhill**



**Alexis Soyer's kitchen at the Scutari General Hospital [FN, 114-115]**
**Soyer had previously been chef at London's Reform Club.**
**There is a boiler or oven (right of centre background) with yet another horizontal flue and a solid-fuel cooker in the left background. What appears to be a flue header can be seen on the extreme right, serving more cooking equipment (?)**

# RENKIOI HOSPITAL, CRIMEA WAR




**Site plan of Brunel's innovative prefabricated hospital erected at Renkioi in Turkey in 1855-56 [EH, 91]**

**One of Brunel's prefabricated hospital buildings erected at Renkioi in Turkey in 1855-56 [Design Museum]**

# I. K. BRUNEL'S PREFABRICATED HOSPITAL FOR TROOPS FROM THE CRIMEA 1855

By Plantagenet Somerset Fry, FRSA

Background. The Crimean War began as another flare-up in the long-stablished antagonism between Turkey and Russia. On this occasion the cause was the refusal of the Turkish government to acede to a Russian demand that Christians within the Ottoman Empire should be protected from insult and violence. War was declared in the autumn of 1853 and within six months Britain and France had intervened on the Turkish side. British motives included a general suspicion of Russian intentions in the Near East, and a more particular wish to retaliate for Russian interference in the Hungarian Revolution of 1848-9. Napoleon III of France sought military glory in an external campaign in order to bolster up the authority and prestige of his regime at home.

None of the powers was really ready for a major war, least of all Britain. The British army was still thinking in terms of warfare and organisation relevant to the age of Waterloo. It had been consistently- and scandalously neglected by Parliament for decades. The commander-in-chief appointed for the war, the ageing and one-armed Lord Raglan, had not been in action for thirty-nine years. If the Russian army had been better organised and equipped it should easily have overcome the British.

The worst feature of this inglorious page of British military history was the incidence of disease among the troops and the appalling administrative chaos which surrounded the means to deal with it. The Turks had generously put at the disposal of the British for a hospital, some buildings at Scutari (now Uskudar) on the Bosphorus, opposite Constantinople. The British accepted these with alacrity, either ignorant of, or indifferent to, the total lack of facilities which they afforded.

The first British and French landings in the Crimea were made in September 1854. The principal objective was the capture of Sebastapol, a city containing the naval base for the Russian Black Sea Fleet, which had been fortified only a few years before. A joint Anglo-French force of some 50,000 men were sent in to begin siege operations which in the event lasted for a year. Two battles were fought early on, at Balaclava on the 25th October and at Inkerman on the 5th November, but despite British and Russian heroism of the best kind, the results were inconclusive. The siege went on.

Then the Russian winter set in. British troops, already short of supplies because about thirty transport ships had been sunk in the Black Sea and because the army commissariat bungled the distribution of the remaining stores, now had to endure not only the appalling cold but also cholera, dysentery and pneumonia. Hundreds of men were shipped out to Scutari where they found conditions worse than in the battle area. By the beginning of 1855 there were more men in hospital than in the front line.

What were the conditions at Scutari? There was no proper water supply or drainage arrangements. Drinking water was contaminated, through, as it was later discovered, the putrefying carcass of a horse lying in the reservoir. There were few stores or utensils, and no soap, towels or clothing. Sick and wounded men lay together, their uniforms filthy and verminous. For every man who died of his wounds three died of disease. The hospital authorities appeared to be doing very little to improve conditions. The death rate was about 50% in November 1854 and would doubtless have risen but for the timely, spirited and now immortal efforts of Florence Nightingale, who went out to

Scutari in November with a team of nurses. In three months she did a great deal to clean up the hospital and better the chance of survival for the patients. But she ruined her own health in the effort.

Her disclosures about the conditions at Scutari to her friend Sidney Herbert, the Secretary for War, which leaked out to the press, generated a scandal of the first magnitude. They horrified the nation and they brought down the government of Lord Aberdeen. On 26th January 1855 the radical member for Sheffield, John Roebuck, moved a resolution in the Commons for an enquiry into the conduct of the war in general and into the scandals in particular, and it was carried by 305 votes to 148. Aberdeen thereupon resigned and was succeeded by the popular Lord Palmerston.

In February Palmerston arranged for Lord Panmure, newly appointed Secretary for War, to organize a Commission to visit Scutari, inspect the hospital and make recommendations. In the meanwhile, the Permanent Under-Secretary at the War Office, who had survived both the scandals and the fall of the government took it upon himself to make some additional arrangements.

The new government takes action. The Under-Secretary was Sir Benjamin Hawes, brother-in-law of Isambard Kingdom Brunel, regarded then - and more so now - as the leading engineering genius of his age. Hawes and Brunel were not only relatives by marriage. They were also the best of friends, each deeply respecting the other for like qualities of drive, determination and integrity, and it was to Brunel that Haws now turned.

On the 16th February 1855 he wrote to Brunel and asked him to design a portable hospital that could be shipped out to the Far East.

There was nothing new about portable buildings - they had been made from time to time at least since Roman days - nor was it exceptional for such buildings to be commissioned officially. Indeed, in the same war portable barrack huts were supplied for the troops near the front line. Thus, when Brunel received Hawes' letter he thought no more of it than just as another call upon his services. As may be expected Brunel gave the problem his undivided attention, demonstrating the same originality of mind and accuracy of detail as he did on every other project of his unique career.

L.T.C. Rolt, author of what is probably the definitive biography of Brunel, thinks that since Brunel answered Hawes' letter by return he must have been turning the problem over in his mind before Hawes wrote. Possibly they had already discussed it and the letter was but confirmation that Brunel should press on with the scheme. Brunel answered "I think I ought to be able to be useful and .. my time and my best exertions without any limitations are entirely at the service of Government .."

The Government was indeed fortunate in having the services of the best man.

Brunel's project. Within a week of Hawes' letter Brunel had worked out a scheme and had on his own initiative placed contracts for the construction of enough buildings for 1,000 sick men. On 5th March he wrote to Hawes with an outline of his plan "The aggregate of the buildings should consist of such parts as might be conveniently united into one whole under great variations of conditions of the form and nature of the site. That (sic) the several parts must be capable of being formed into the whole united by covered passages, and that it should be capable of extension by the addition of parts of any size."

In his time Brunel was responsible for an extraordinary number and variety of engineering, architectural, marine and other projects and designs. But this

experiment in prefabricated component buildings is almost the only project about which he printed a detailed account. It can be read in the Appendix to The Life of Isambard Kingdom Brunel, Civil Engineer, by Isambard Brunel, Longman 1870. As his granddaughter Lady Noble said in her book, The Brunels, Father and Son, "He thought of everything" by which she meant fixed basins with water laid on, invalid baths on wheels into which patients could be lowered at their bedsides on a frame, ventilation of fresh air drawn by mechanical pumps, kitchen and washhouses fitted up with mechanical contrivances, and to each ward a small boiler for handy use, heated by candles.

When the hospital parts were ready for shipment, Brunel, who appears to have organized the transportation, decided that the public might like to inspect the buildings, and he had two put up at Paddington Station which was then in the last stages of completion. It will be recalled that Brunel was in the main responsible for the design and building of this splendid example of Victorian architectural ironwork.

Selecting the site for the hospital. The War Office, meanwhile, looked around for somewhere to erect the hospital, on the Turkish mainland. It had been decided that the hospital was to be staffed with civilian medical practitioners, and Dr. E. A. Parkes, M.D. was appointed superintendent, with authority to advise on the selection of a site. He was also asked to make contact with Brunel. Parkes' initial impressions of Brunel's scheme was recorded in a report which he submitted to the Secretary for War at the end of 1856, when the war was over and the hospital had been broken up. "I found", he wrote "that the formation of the hospital buildings, their size, shape, system of ventilation, water supply and drainage, had already been considered and fixed by Mr. Brunel, and that every arrangement was distinguished by that perfection of detail and excellence of method which stamp all the works of that distinguished engineer. I was convinced that nothing could exceed the excellence of the mechanical arrangements.."

At the beginning of April medical and purveyors' stores suitable for a hospital of 1,000 men were shipped out to Turkey. Parkes left England on the 5th and reached Constantinople on the 10th. He was joined there by John Brunton, a civil engineer who had been sent out by Brunel to supervise the erection of the buildings. Together they began to inspect the neighbourhood of Scutari which they found unsuitable. For some days the search continued and early in May 1855 they found what they wanted - at Renkioi, in the Dardanelles, not many miles north of the site of ancient Troy, and about 100 miles from Constantinople. It was about two days sailing time from the Crimea.

Their final choice was to some extent dictated by the degree of adaptability of the buildings. The houses could be arranged in various ways, in a straight line, in a crescent, in a square, in two or more lines, but in whatever way they were arranged it was necessary to have at least four acres of reasonably level ground, with enough fall to carry off drainage and a good outlet for sewage. It also had to satisfy other requirements which Parkes wanted, namely a large water supply of at least 25,000 gallons a day (the closets etc. were to be flushed and not emptied into cesspools) and it had to be at a height which would obviate the need for pumping water by mechanical means. Finally, he wanted a site as near to the sea as possible, with good landing places accessible in all weathers, in a location with healthy winds. Renkioi had all this.

The Hospital parts are transported to Renkioi. At first it had been planned to send the buildings to three different sites, to make up three small hospitals in the Bosphorus. Then, when Parkes found the Renkioi site and reported that it was big enough for a large hospital, it was arranged that all the buildings should be sent to Renkioi. On 14th May Brunel wrote to the Transport Board

(later the Ministry of Transport) asking for the parts to be shipped out in larger vessels than had been arranged when the parts were to go there to the three sites. (This letter came into the author's possession in 1967. It provided the starting point for the enquiry which is the subject of this article. The letter was presented in 1968 to the Borough of Swindon to form part of the nucleus of a collection of 'Brunelia' which will be on permanent display at the new town centre being constructed in Swindon, appropriately to be called Brunel Centre).

Another letter written by Brunel in May in connection with transport arrangements reveals his scrupulous attention to detail - "All the vessels" he wrote "with the entire hospital will I believe have left England before the end of the week, that is before the 21st. Finding that none of the Crimean Stores were likely to be ready, and indeed that no positive time could be ascertained for their being ready, I obtained authority yesterday to purchase one third of the required quantity of bedding with some other similar stores, and they are now going abroad with the buildings. I have added twenty shower baths, one for each ward and six vapour baths. You will be amazed to find certain boxes of paper for the water closets - I find that at a cost of a few shillings per day ample supply could be furnished and the mechanical success of the w.c. will be much influenced by this. I hope you will succeed in getting it used and not abused. In order to assist in this important object I send out some printed notices or handbills to be stuck up, if you see no objection, in the closet-room opposite each closet, exhorting the men to use the apparatus properly and telling them how to do so."

Erecting the hospital. On the 21st May, the site having been laid out and the preliminary services installed, the workmen began to erect the buildings. The building parts were designed and constructed so that not one was too heavy for two men to lift and place into position. Brunel had calculated that it should take about a month to put up the whole hospital, but Brunton had so much difficulty with whatever local labour he was able to recruit that in the end he had to rely entirely upon the small gang of eighteen men he had brought out from England, and the erection took longer. By 12th July enough ward buildings and ancillary equipment had been erected and fitted to cope with 300 patients; a month later 500 patients could be accommodated. By December it was ready for 500 patients and by January 1856 for 1500. No more sick men were admitted after the middle of February, but 2,200 could have been housed by March and 3,000 by June, if the hospital had been finished. As it was, the largest number catered for at any one time was never more than 700, which means it was fully operational after three months from 21st May.

The hospital in operation. In his report to the Secretary for War, Parkes described in some detail the functioning of the hospital.

> " On the sides of the hills in the rear were numerous small springs of excellent water, which were collected together and conveyed in earthenware pipes to a large reservoir placed by Mr. Brunton 70 feet above the highest house, which was itself about 60 feet above the sea. From this reservoir the water was carried in iron pipes down the centre of the long corridor, and at every ward which was placed at intervals at either side of the corridor a leaden service pipe came off, and led an abundant and never-ceasing supply into the ward cisterns, which supplied the baths, lavatories and closets. By this arrangement all necessity for pumping water was avoided and the sewers were able to be flushed perfectly. '
>
> The plan of the hospital may be at once understood by imagining a covered way, open at the sides, and 22 feet wide, running nearly east and west, and reaching for a length of more than a third of a mile, on either side of which stood, at intervals of 27 feet on the south side, and in most

cases 94 feet on the north, the thirty-four houses each of which was 100 feet ong, 40 feet wide, 12 feet high at the eaves and 25 feet high at the centre, and was capable of containing 50 patients with an allowance of nearly 1300 cubic feet of air for each man. Some portion of this space was occupied by the closets and some small rooms used as orderlies' rooms and bathrooms. Thirty of these houses were used as wards; four as dispensaries and purveyors' stores. To the south of each division of ten houses was placed an iron kitchen which afforded the necessary accommodation for preparing 500 diets. At the inland extremity of the corridor were placed two iron laundries the water from which (some 4000 gallons daily) was passed into the sewers. Beyond the laundries were placed on either side the wooden houses of the medical and other officers, who were thus able to see down either side of this long line, and to preserve to a certain extent surveillance over the patients.

Nothing could exceed the simplicity of the arrangement; it was a repetition of similar parts throughout, and experience enables me to say that nothing could be better adapted for a hospital than this system of isolating buildings, between everyone of which was a large body of moving air, rendering ventilation easy, and communication of disease from ward to ward impossible.

For the construction of the hospital every necessary part was sent out by Mr. Brunel."

From the date of the first admission to the date of the last, 1,331 patients passed through the hospital. Of these, 961 were cured and discharged, 320 were saved but invalided in one way or another. The number of deaths was only 50, less than 4%.

The hospital is dismantled. The Crimean War ended in February 1856. Sebastopol had fallen in the previous September, and at the end of 1855 Austria had threatened to join Britain and France. This persuaded the Russians to accept peace terms which were confirmed at the Congress of Paris. Among other things, the Russians agreed to give up pressing for toleration of Christians in Turkey. Russian warships, moreover, were prohibited from using the Black Sea.

Brunel, by this time absorbed with the greated design project of his career, the steamship Great Eastern, insisted that the hospital should not be indiscriminately broken up. "I don't want the thing to be flung into a ditch when done with" he wrote to Brunton "but should prefer a useful end: that each part should be made the most of, and methodically and profitably dispensed of. Brunton accepted the injunction, and with considerable skill and no little difficulty he organised the dismantlement and disposal. He has left some notes of his adventures in this commission.

"Very soon after peace was declared and I got orders to advertise and sell everything at the hospital by public auction..advertising placards were printed and sent in every direction" Brunton tried to persuade the Turkish government to purchase the whole of the hospital, suggesting that it would make a good military school. But the Turks were not interested, and an auction was arranged.

A few days before the auction, a serious fire broke out in Salonika and it made thousands of people homeless. When the first day of the auction arrived a deputation of local officials from Salonika was present and up in front among the bidders. For some time the sale proceeded smoothly and good prices were realized. Then some of the machinery lots came up. Brunton was particularly interested in these and had valued them at about £10,000 for the

whole lot. Bidding began very slowly and it ground to a halt at below £500. The auctioneer, who had been instructed previously not to knock any item down without a nod from Brunton, paused with his hammer raised.

"I went to him" wrote Brunton" and asked him to point me out the bidder of this amount, which he did and I at once recognized a Greek, who was a sort of agent for the British Consul, Calvert. I sought out Calvert in the crowd and remonstrated with him. I knew all the people in the Dardenelles held him in such dread that they dared not bid against him. Calvert said "Come, Brunton, knock this lot down; you know your orders are very strict; you must sell everything by public auction".

Brunton protested and said he certainly would not knock it down for any such price. If Calvert wanted the lot he must bid something near its value. "Calvert calling me aside said "Look here, Brunton, knock it down and I will give you an undertaking that you shall have half the profits". I was staggered that such a proposition as this should have come from a British Consul. "No Calvert" said I "you have the wrong pig by the ear this time". I called out at once to the auctioneer "£1,000 for this lot. I buy it in".

Brunton then arranged for the remaining parts to be shipped back to England where he believed that he could sell them for better prices.

Final disposal in England. A few days after Brunton had completed the disembarking of the parts in England, the government's Medical Department advertised for tenders for 500 water closets and a number of lavatories for the military hospital at Netley, near Southampton, which was being constructed. Brunton sent a tender which was accepted and Netley bought everything except for about 60 ventilating fans. These Brunton sold to the Admiralty for adaptation and use for ventilating stoke-holes in naval gun-boats. The sale of the hospital was complete.

There is no record of Brunton reporting his adventures to Brunel, but the great man would have certainly been pleased with the thorough way in which his colleague handled the disposal.

Do any of the buildings survive? For many years it has been believed that one of the hospital buildings found its way to the military establishment at Aldershot, and that it was eventually converted for use as a chapel, the Roman Catholic Chapel of St. Michael, on Stanhope, Linc. It will be recalled that Brunton disposed of everything in Turkey or in London. The only possibility therefore, was that the hut at Aldershot was one of those Brunel had put on display at Paddington.

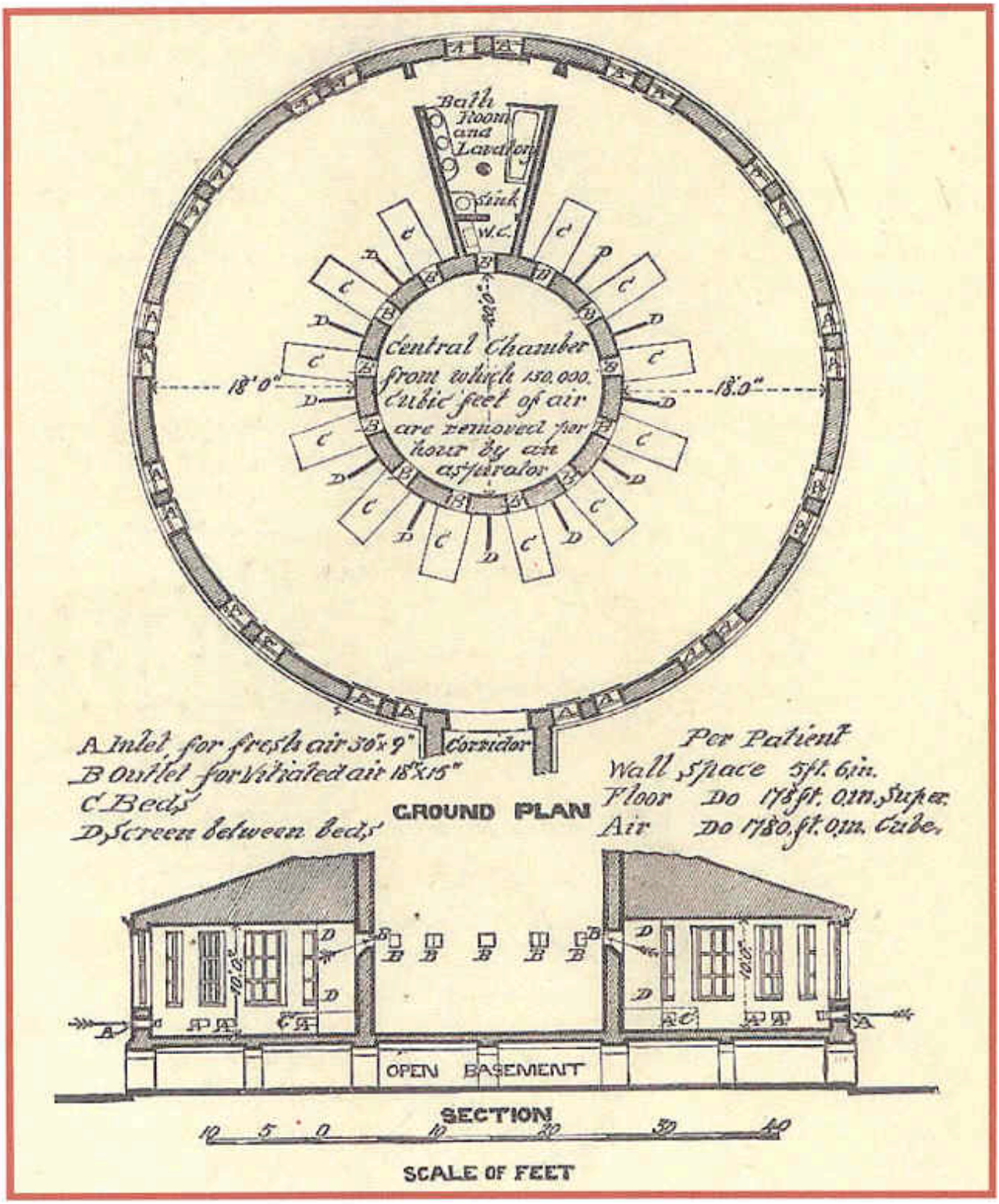
By kind permission of the present padre, Father Gillingan, the chapel has been examined by the author and an architectural expert. It is our opinion that the chapel is not one of the Brunel buildings. None of its dimensions match those of the Brunel buildings. Its structural characteristics are dissimilar. The roof truss arrangement in particular is quite different. Nor is there any evidence that the chapel could have been adapted, enlarged or was assembled from a Brunel building.

Enquiries in Turkey have failed to elicit evidence of any surviving buildings, and as none were brought back to England in 1856 one is driven to the reluctant conclusion that there are no relics of this imaginative and successfully operated hospital. There is, however, some documentation and apart from the correspondence and the reports mentioned, the University of Bristol possesses several sketch drawings by Brunel of various items of the structure and its ancillaries. There are also, maps, plans and other papers in other collections.

# PARK HOSPITAL, READING

**Scarlet Fever Ward [CAC, fig.113]**
**Hospital built 1906, notice the two sets of heating apparatus.**

# SANDERSON'S CIRCULAR WARD




**Design for mechanical ventilation [VH, 304-307]**

# SANDERSON-S CIRCULAR WARD

**Dr Burdon Sanderson proposed a plan (1880s?) where all air discharged from a small-pox ward should be at a high temperature. His ward was in the form of a ring with an air extraction chamber in the centre of the ring. He intended that for a ward of 12 beds, the extract air rate should be about 120,000 cubic feet per hour in total. "The beds would be arranged as near as possible to and immediately below each extracting opening, and would be placed against the internal wall, and each bed would be placed between two of the septa or screens which pass to a certain distance out from the internal wall into the annular space, so that the head of each bed would be included in the space between each two neighbouring septa. The space within the ring communicates with the annular space by extracting openings, and discharges the air into a chamber, where it could be subjected to a higher temperature, so as to destroy all organic matter it might contain."**

**The windows were designed not to open. Twenty-four openings for fresh air are made in the external wall, each having an area of 2 square feet. The movement of air through the outlet openings was designed to be at the rate of "1 mile per hour" (about 1.5 feet per second), allowing 10,000 cubic feet of air for each patient, and to secure this slow movement and thus prevent draughts, the outlet openings were also planned for 2 feet square. The proposed method of warming is by hot-water pipes in front of the inlet openings. It was intended that a fan (or aspirator) pass the extract air to a gas furnace, probably in the roof. The drawing shows the extraction rate as 130,000 cubic feet per hour which may indicate the increase in volume due to the rise in temperature.**

*Circular wards were used in the City Hospital at Antwerp and for two wards in the Liverpool Royal Infirmary.*


Henry Lea

Branch duct to ward

Louvered extract lantern

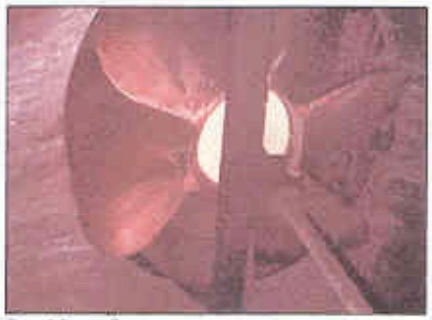
***ROYAL VICTORIA HOSPITAL, BELFAST***

Henman's original perspective

## Royal Victoria Hospital, Belfast, 1898-1903

The architect and engineer for the Birmingham General Hospital of 1893-97 were William Henman and Henry Lea, assisted by the Glasgow engineer William Key, a pioneer of plenum ventilation. In 1898, Henman and Lea were appointed for the new Royal Victoria Hospital in Belfast. Both knew there was scope for the improvement of environmental systems. Operating theatres and 17 wards were provided under a continuous roof. A very large brick lined air duct 9 ft wide and 433 ft long ran beneath the main corridor. Lea determined this size was necessary to provide 7 air changes/h in winter and 10 in summer. Two fans, each of 9 ft 2 in diameter were provided, driven by a steam engine, with the exhaust steam used to heat domestic hot water. The local engineer Samuel Cleland Davidson played an important role. The Davidson Works was producing some of the world's most advanced centrifugal fans and was responsible for designing, installing and maintaining much of the central plant. A sprinkler system, used to moisten the fresh air filters, was regulated on the basis of regular readings of wet and dry-bulb temperatures, a very early example of the conscious control of humidity. Much of the central plant remains in place, including the steam engine which is still operational.

More information is contained in "Henry Lea, Consulting Engineer, 1839-1912," Henry Tovey, Houre Lea & Partners, undated.



Davidson fan

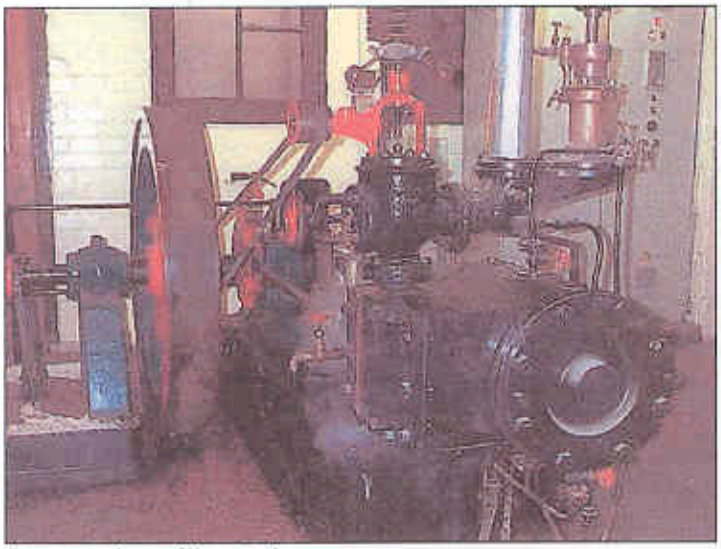
# ROYAL VICTORIA HOSPITAL, BELFAST

South side of ward block 1903

Samuel Cleland Davidson

One of the Wards

Coconut fibre rope filter wetted by sprinklers



Steam engine, still operating