The Grandfather of Air-Conditioning – The Work and Influence of David Boswell Reid, Physician, Chemist, Engineer (1805-63)

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INTRODUCTION

The term air-conditioning originated in the United States and it is usually assumed that the first air-conditioned buildings appeared there after the introduction of refrigeration into building services. This paper demonstrates that air-conditioned buildings first appeared in the United Kingdom in the middle of the Nineteenth Century and that the prime instigator was David Boswell Reid **(Fig.1)**.

The paper will start by looking at Reid the man and his formative years. It will then look at some of the more well known of the countless buildings he was associated with, concentrating on the Houses of Parliament and St George's Hall in Liverpool and will finally consider his influence in the United States, where he spent the last years of his life.

Figure 1. Dr David Boswell Reid

REID’S EARLY YEARS IN EDINBURGH

David Boswell Reid was the second son of Peter Reid, a distinguished physician and educational reformer. His older brother followed their father into the medical profession and it was therefore natural that David carried on the family tradition and studied medicine at Edinburgh University. In 1826 he became Senior President of the Royal Medical Society (this was the medical students society, founded in 1734). Two of his contemporaries are worthy of note, Charles Darwin studied medicine at Edinburgh from 1825 to 1827 and William Henry Duncan was also a fellow student. Duncan was to become the United Kingdom’s first Medical Officer of Health when he was appointed to that position in Liverpool in 1847 at a time when Reid was actively engaged in that city at St George’s Hall.

Reid received his Medical Diploma in 1830 and was made a Fellow of The Royal College of Physicians, Edinburgh in 1831, however, he had been appointed as assistant to Professor Thomas Hope in the Chemistry Department at Edinburgh University after Reid had, quite independently, started teaching practical chemistry the year before. Sometime between 1830 and 1833 Reid became involved with the Medical Charities of his native city and during this time became acutely aware of the inter-relationships between poor health, poor sanitation, poor hygiene and poor ventilation. He took it upon himself to enlighten the public mind on the removable causes of disease. He published a pamphlet entitled ‘The Chemistry of Daily Life’ in his quest to educate the population of over-crowded cities.

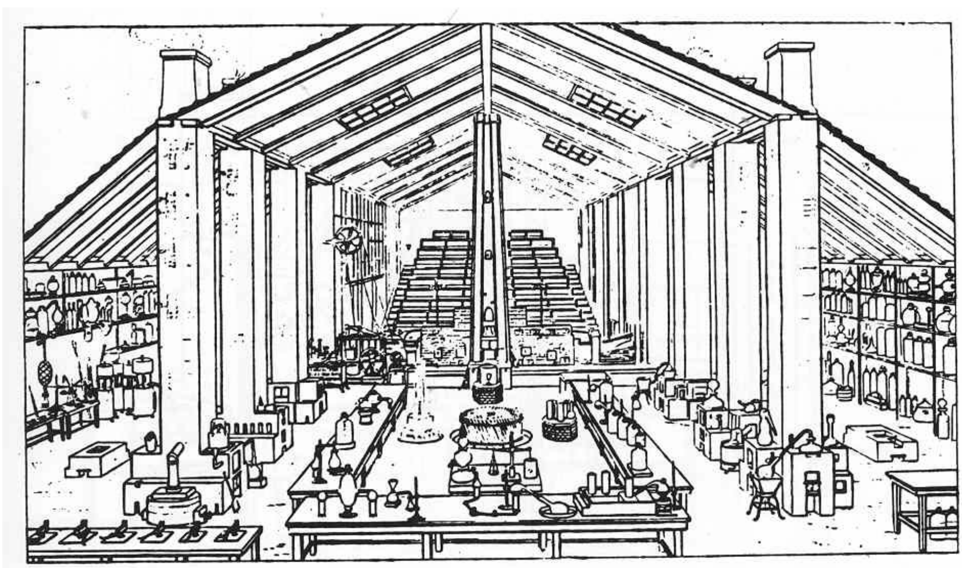

Figure 2. Reid's Chemistry Laboratory (Reid, 1837)

Reid petitioned the Town Council, which controlled the University, to set up a chair of practical chemistry but was unsuccessful so in 1833, after a disagreement with Hope, he had his own independent chemistry lecture and demonstration room constructed. A contemporary illustration **(Fig.2)** shows how he had incorporated fires into the principal demonstration table. These fires were fed by air entering from above such that the smoke (and extracted fumes) travelled downwards and through ducts under the floor to reach the chimneys. He refers in detail in his book (1844) to the care he took to ensure good acoustics in his lecture/demonstration suite and to tests done in the presence of Earl Grey, Lord Brougham and others. He later constructed five adjoining test rooms for his investigations of ventilation and respiration. He used these rooms to try to establish the precise amount of air required for health and comfort with practical experiments on human guinea pigs. None of his notable predecessors, in the field of the study of the chemical properties of air or the relationship between freshness of air and disease, had done this.

In 1834 the British Association for the Advancement of Science held its Summer Meeting in Edinburgh and a number of the delegates visited Reid's laboratory and classroom to view his unique arrangements for heating, lighting and ventilation. Among this group were Members of both Houses of Parliament.

THE HOUSES OF PARLIAMENT

In October 1834, a serious fire destroyed most of the Parliament Buildings and when a Commons Committee was established to enquire into the ventilation and acoustics of a new building, Reid's work in Edinburgh was brought to its attention. A Temporary House of Commons was speedily erected to Reid's design with Lord Sudeley acting as architect.

In the system employed in the Temporary House, which was actually in use for some fifteen years, air was drawn in from New Palace Yard (although Reid's original design involved the use of a high turret), whence it passed into a basement plenum chamber, where it was heated or cooled. The air then passed through numerous apertures in the floor, upwards through the Chamber and eventually into a false ceiling connected to a downcast shaft. The vitiated air then became the combustion air for a furnace at the base of a chimney 120 ft (36 m) high **(Fig.3)**. This was probably the first instance of what we would now call 'displacement ventilation'.

Lord Sudeley, Chairman of the Commissioners who selected the design for the New Houses of Parliament, said in the House of Lords "The ventilation of the [Temporary] House of Commons was complete and perfect – and the first plan of systematic ventilation ever carried out in this or any other country". In a written report he stated 'To the skill, zeal and determination of Dr Reid, it is owing that the members of the House of Commons can now pursue their senatorial duties without a sacrifice of either health or comfort. To him we owe the solution of the problem, that, by a proper system, ventilation may be obtained in the most trying and difficult circumstances' (Harris in Reid, 1858). In 1835, Sir Benjamin Hawes, Chairman of the Committee on Acoustics and Ventilation, which had originally recommended Reid's appointment, wrote to Reid 'You have facilitated public business, and prolonged the lives of public men' (Harris in Reid, 1858).

The Committee of the House of Commons in its report in August 1846 stated 'The great improvement which Dr Reid has effected in the atmosphere of the existing House of Commons, [the Temporary one] can be appreciated by every Member of the House; and your Committee entirely concur in what they consider to be the general opinion in its favour' (Harris in Reid, 1858).

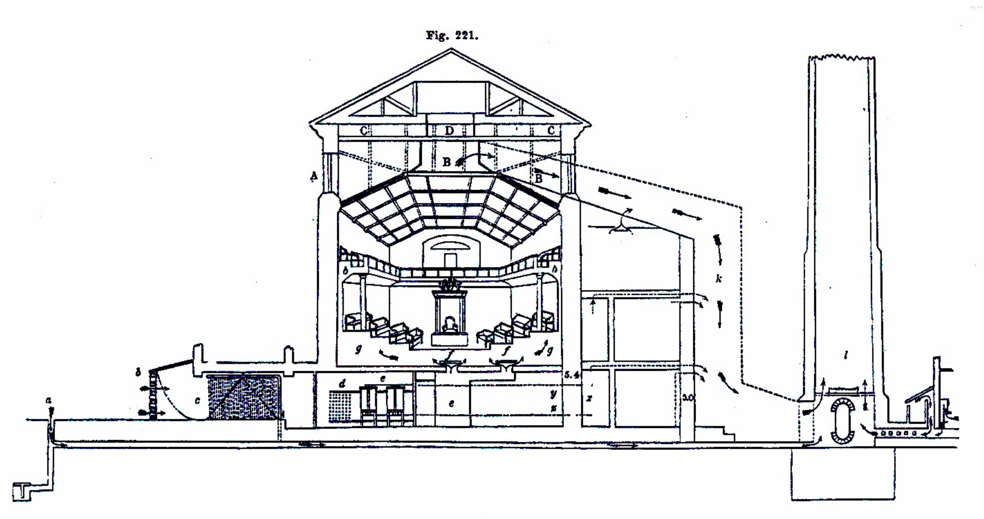

Figure 3. Temporary House of Commons (Reid 1844, Fig. 221)

It is very clear from all the comments above that Reid's system for the Temporary House not only worked, but worked extremely well up until the time the New Houses of Parliament Building was ready for occupation in 1852. The essential features of the system were as follows:-

1. a means of filtering the outside air, this was done with a veil 42ft (12.6m) long by 18ft 6in. (5.5m) deep;
2. a means of heating and moistening the air, this was done in a chamber below the House connected from below to an equalising plenum space immediately below the floor;
3. the facility to mix the heated air with unheated fresh air so that the temperature of supply could be varied as required;
4. a means of controlling the speed of throughput of air, this was done with a single valve between the extract duct in the roof space and the downcast shaft connected to the furnace and chimney;

5. the facility to run cold water through the heating pipes in summer to provide cooling and dehumidification (ice could be used in extreme weather).

Reid appears to have taken his duties very seriously and he would often stay in personal control of the system when the House was in session. His instructions were that the velocity of air supply was to be varied, not only in relation to temperature, but also in relation to the numbers present. He recorded that the number of variations applied to the system over a single sitting often varied between 50 and 100. The velocity of the air was to be increased when the temperature was high and he indicated that the building should be cooled overnight in summer by drawing air through it 'when the Members have retired'. In very hot weather cold (mains) water could be supplied to the heating coils or the air could be cooled 'in rare cases, by the use of ice', however, he adds 'but no mode is more capable of regulation, so economical, and so readily available, as a variation of velocity' (1844). Not only do we have an engineer here who understood the benefits of night purging, he also gave much consideration to economy of system operation.

One or two details of the system indicate Reid's thoroughness and are worthy of special mention. Reid made sure that the atmosphere supplied to The Speaker was separately controlled since he may be required to remain still for long periods of time, he also realised that people in the galleries would require a higher velocity for comfort because they were that much nearer to the gas lights, which, by their very nature, radiated large quantities of heat. It was possible for the controller of the system, in the lower levels, to check on the temperature in the House by means of a thermometer, which could be raised and lowered by means of a cord and pulley.

Reid's involvement in the New Houses of Parliament Building, which began almost as soon as Charles Barry had been appointed architect, did not lead to such a successful outcome. Barry, who was ten years older than Reid, did not take kindly to being told how wide or how high his towers had to be for ventilation purposes. The Commons Committee charged with investigating proposals for the New House had recommended that the 'whole space immediately below the two houses …… as well as between the ceiling and Roof should be prepared and altogether reserved for such arrangements as may be necessary' (Parliamentary Papers, 1835 (583)). However, it was apparent that Barry was unwilling to make the architecture subservient to the ventilation and he continually put obstacles in Reid's way, complaining, for example, about the costs of the central vitiated air tower, the ducts under the floors and roofs, the vertical airshafts etc. In 1845 there was a major row between the two men and Barry accused Reid of creating problems.

Reid, who had very strong opinions and a fiery temper, became so perplexed with the fact that Barry kept making alterations without, Reid would claim, due authority, that he was 'determined to cast off all responsibility unless proper arrangements were made in future for controlling the proceedings of the architect' (1858). Between 1846 and 1852 he would only attend the project under protest and his salary was stopped. Building work was held up for *four years* at one point.

Reid's original scheme, which involved taking in air from high level at both ends of the building, through St Stephen's Tower (within which Barry had insisted in incorporating a clock and bells) and the Victoria Tower, and allowing vitiated air to escape through a spire-shaped tower over the Central Hall, was never fully brought to fruition. He was unfairly pilloried in the press, especially The Times.

In addition to his work on the heating and ventilation, Reid was called upon to use his expertise in acoustics to improve matters in the House of Commons and the ceiling was lowered on his recommendation. He was also asked, in 1844, to design the gas lighting for both Houses, but in 1846 the lighting of the Lords was given to Barry. Reid used 64 Argand burners behind glass panels to light the Commons after the ceiling had been lowered with what were probably the very first air-handling light fittings.

In 1852, the Peers were persuaded by the Marquis of Clanricarde to isolate their House from his plan, despite the dissenting voice of the Duke of Wellington amongst others. The Government followed the Lords' lead and handed over all design to Barry, however, a few weeks later they repented and asked Reid to come up with a satisfactory solution for the House of Commons. The building was physically split by means of screens below the Central Hall so that Barry could ventilate the Lords and Reid the Commons, although Reid still maintained that he could not produce a working system unless more control was placed on the architect by the Government. The result of this was that neither system worked properly when eventually they were first occupied for business at the start of the 1852 session.

Reid was, once again, expected to shoulder the blame, but he had been constantly requesting a full investigation of the whole process and eventually, in a vote which called him to the Bar of the House, the Government was defeated by more than two to one. He then pointed out the utter impossibility of their having any comfortable atmosphere in their New House until Barry's alterations to the original arrangements were put right. He was then empowered by the Government, in addition to other works adopted immediately during that session, to execute no less than thirty-five recommendations, which he afterwards made. He was also granted the arbitration he had so long demanded and he insisted on his right to cross-examine the architect at the enquiry which followed. Reid's cross-examination of Barry lasted for *seven successive days* and the whole investigation took thirty days. Reid was awarded compensation totalling over £3 700, he was also paid six years salary (£4 400) retrospectively. This was presumably the first case of a person suing the Government for 'unfair dismissal'. The fact that Reid was totally vindicated appears to have been forgotten by later writers, for example, Sir Robert Cooke (Cooke, 1987).

A major bone of contention between Reid and Barry was that Reid did not seem to consider draughting to be part of his work and he steadfastly refused to produce any drawings. He must surely be criticised for this but, strangely, he was quite happy to produce drawings for St George's

Hall and so one might deduce that this had more to do with his problems with Barry than with obstinacy.

Percy reported (Parliamentary Papers 1866 (981)) that ‘there are many hundreds of air-courses under as well as above ground, beneath floors, in walls, over ceilings, and in roofs; …… there are enormous smoke-flues running horizontally within the and immediately under the roofs, with hundreds of chimneys in communication; there are, it is asserted, steam pipes of which the aggregate length is about 15 miles, and about 1 200 stopcocks and valves connected with these pipes; and there is a multitude of holes and crannies as intricate and tortuous as the windings of a rabbit warren’. It took Percy and two draughtsmen over six months to make a record of the building services as they existed at that time.

During the time he was involved with the Houses of Parliament, Reid was a Commissioner of the Health of Towns Commission, which eventually led to the enabling of the Public Health Act.

ST GEORGE’S HALL IN LIVERPOOL

In Liverpool in the early Nineteenth Century a triennial music festival had been held for a number of years and the Merchants of the City, who had grown rich importing goods such as cotton, tobacco and rum, decided that the city should have a large, purpose-built hall for this festival. The main concert hall was to be big enough to hold 3 000 people plus an orchestra or choir of up to 400.

The City Merchants were so confident that they could raise the money that the Foundation Stone was laid on the day of Queen Victoria’s Coronation in June 1838. A design competition was announced in The Times in March 1839 and the design of the young London architect Harvey Lonsdale Elmes was chosen in July 1839. However, the Merchants had only raised about £30 000, which would not have allowed Elmes’ grandiose classical concert hall building to be erected and it was very fortunate that the Law Courts Committee of the city had obtained funding for a new court building. This was to house the main Crown Court and a Civil Court of similar size.

Another competition was announced for the new court building and there was considerable disquiet among the other entrants when it was announced, several months after the closing date, that Elmes had also won this competition and within weeks that the two buildings were to be combined. A few months later Elmes who had been to lectures given by Reid about ventilation in London, requested that the Law Courts Committee appoint Reid as ‘Ventilator’ and he was appointed in April 1841.

Reid’s original plan allowed for all flues and fireplace chimneys, and all vitiated air, to be brought down to basement level and taken through underground tunnels to a vast ventilation chimney behind the proposed Daily Court Building on the opposite side of the street **(Fig.4)**. He had stated in his book that it should be possible to provide hot water, steam and ventilation to districts in the same manner as gas, water and sanitation (1844). Considerable construction work had been completed, in fact work had reached the principal floor of the Great Hall, when ‘the intention of constructing new daily courts was abandoned’ and ‘the whole suite of arrangements for warming and ventilating had to be altered’ (Reid, 1855).

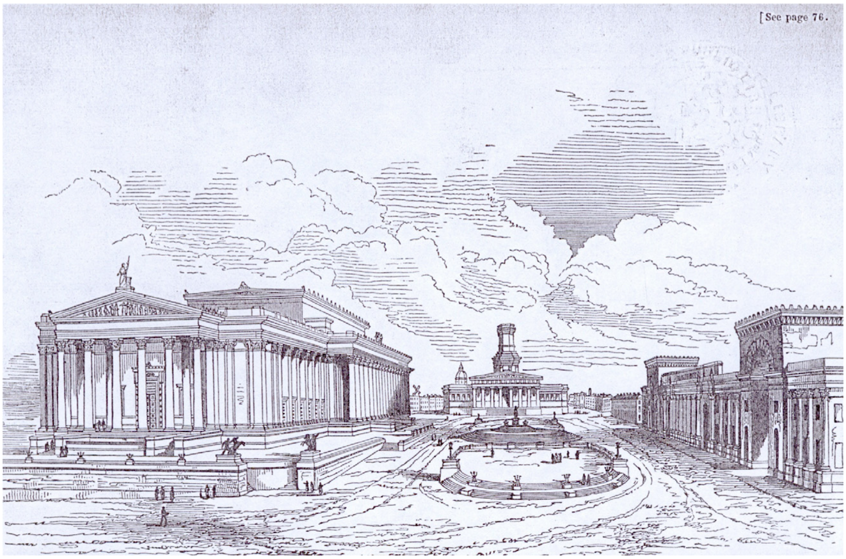

Figure 4. Proposed Ventilation Tower in distance (Reid 1844, frontispiece)

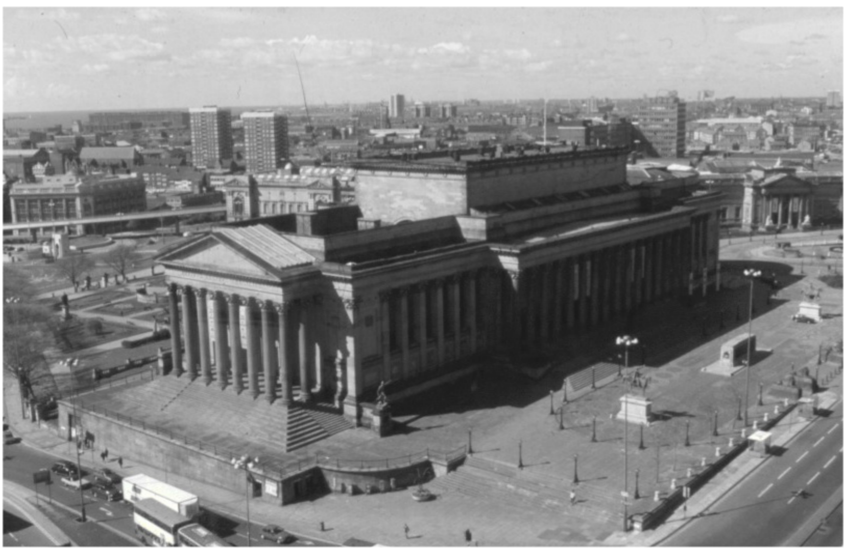

Figure 5. St George's Hall today

Reid explained that this change meant that some of the minor apartments had now to rely on doors and windows for ventilation because of ‘the expense that would have attended a different arrangement of vaults and foundations, such as would have been more suitable had they been commenced on the plan now adopted’ (1855).

Despite the difficulties outlined above and the fact that the building, with its Great Hall, two separate Law Courts and Small Concert Room, resembled a series of separate public buildings aggregated together rather than one single building, it was a triumph for both Elmes and Reid in terms of its functionality. It is considered by many to be the world’s first air-conditioned building and in 2005 was awarded a plaque by the Heritage Group of the Chartered Institution of Building Services Engineers, to this effect.

All of the features Reid had outlined as essential for successful application of ‘systematic ventilation’ were incorporated into the warming (or cooling) and ventilation arrangements for the principal spaces. The main driving force was a 16 hp (12kW) steam engine driving four vast paddle fans 10ft (3m) in diameter, with blades 5ft (1.5m) by 2ft 6in. (0.75m). By varying the speed of the steam engine and changing the number of fans operating at any one time, the air supply rate could be varied from 1 000 ft^3/min to 50 000 ft^3/min (0.5m^3/s to 25m^3/s).

Figure 6, Great North Water Apparatus

The air was heated by means of two hot water boilers and two steam boilers, all fuelled by coke – Reid was very conscious of the health problems associated with chimney smoke in cities. The two main heating coils (the Great North and the Great South Water Apparatus) consisted of 72 x 4in.

(100mm) steel pipes about 30ft (10m) long **(Fig.6)**. There are two smaller coils for heating the Small Concert Room and the North Entrance Hall and one for the South Entrance Hall. In addition there were 27 pipe coils heated by the steam boilers. The steam coils were only to be used in extremely cold weather because of Reid's belief that heating the supply air to a very high temperature was detrimental to comfort. However, in winter, the steam coils would be employed for pre-occupancy warm-up. This was effected by closing all the normal escape routes for vitiated air and re-circulating the air to the fan chamber by allowing the flow to be reversed through the low-level supply grilles in the Great Hall. Humidification was obtained by direct injection of steam into the air stream under the main heating coils. Reid insisted that this steam must come from a separate boiler used solely for that purpose and that only copper pipes were to be used in association with it **(Fig.7)**.

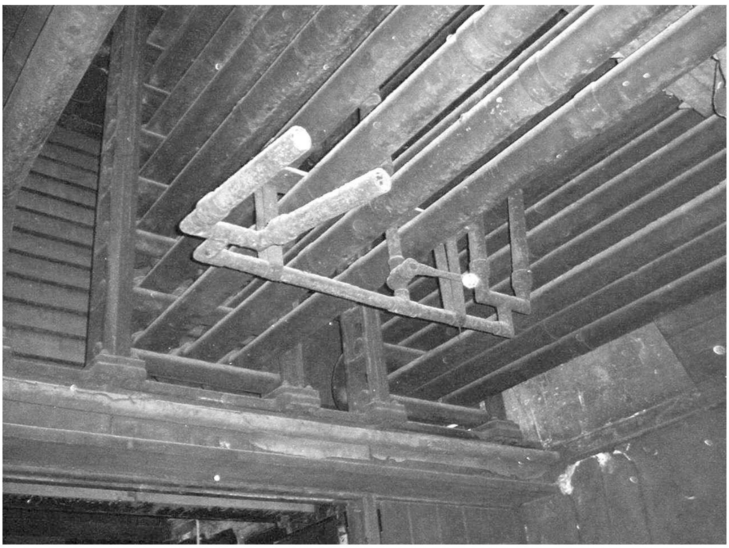

Figure 7. Steam Injectors

A complicated system of ducts and 'valves' allowed treated air to be sent to any combination of the principal spaces or where a very rapid warm-up was required, all four fans could be made to operate on a single space. The 'valves' in this case are large doors of sized canvas over a timber frame **(Fig.8)**. Wooden louvre dampers and canvas roller blinds were used for fine-tuning.

Supply from the main system into all the principal rooms is at low level but the system allowed supplementary (untreated) fresh air to be introduced directly as required. Vitiated air was encouraged to escape from the Great Hall into the roof space, the roof having louvres round all four sides (but below the parapet). Extract grilles, with openable flaps above, were skilfully incorporated into the ceiling decoration **(Fig.9).** The roof louvers were controlled so that only those facing away from the wind direction would be opened.

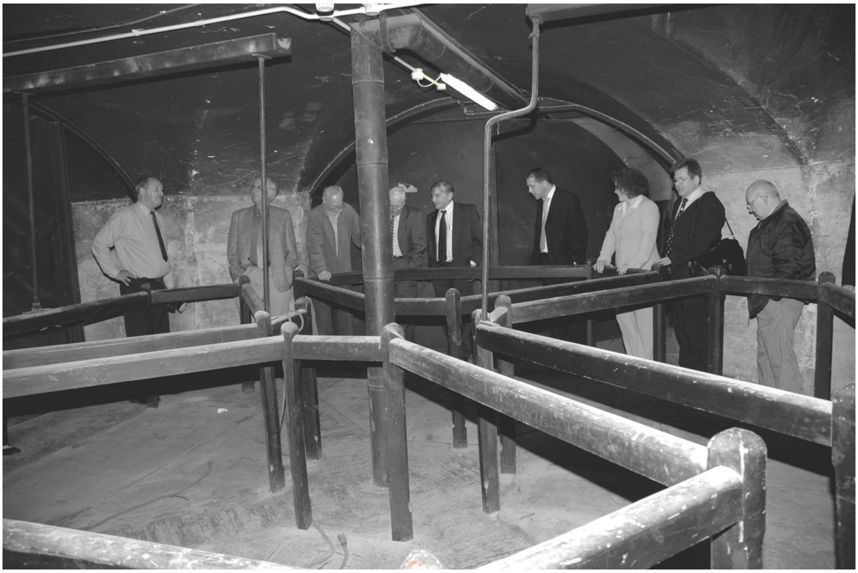

Figure 8. Air Valves Under Centre of Great Hall

Figure 9. Ceiling and Balcony Niche of Great Hall

A section and plans of the principal supply ducts is shown below **(Fig.10)**

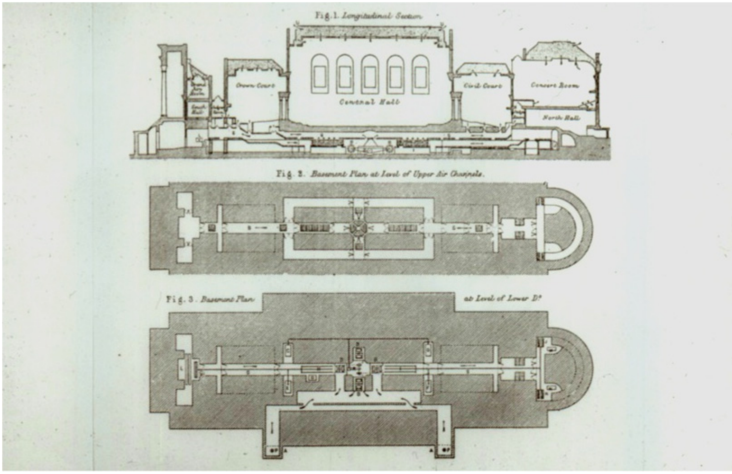

Figure10. Principal Supply Ducts (MacKenzie, 1863 from Reid, 1855)

All other principal rooms and many of the ancillary spaces had their air extracted into four main vertical extract shafts, one next to each corner of the Great Hall. Each of these also contained a boiler flue. Fish-tail gas jets could be burned at the bottom of these, or in one case, a coke brazier, to boost the buoyancy of the air and increase the extract rate **(Fig.11)**. Chimney flues from those rooms with fireplaces, were fed into a separate vertical flue alongside these shafts and again, when necessary, a coke brazier or gas jet could be ignited at the bottom of these vertical flues.

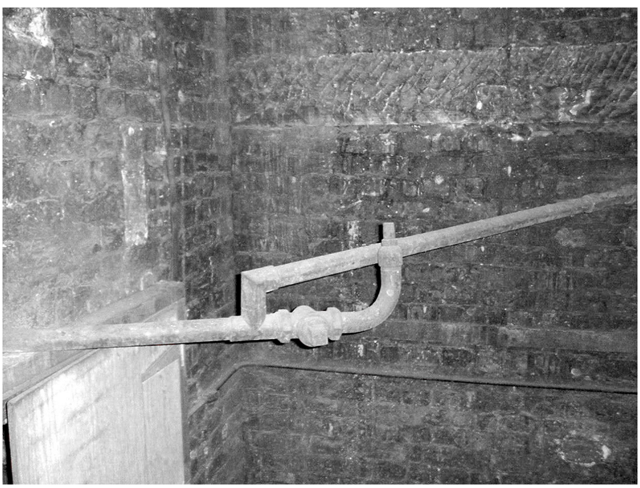

Figure 11. Location of gas jet at base of extract shaft

The rate of extract from the Court Rooms could be closely controlled by adjusting flaps in the roof space **(Fig.12 & 13)**.

Figure 12. Court ceiling showing air outlets

Figure 13. Flaps above air outlets

For the two Courts and the Small Concert Room it was possible, in warm weather, to allow vitiated air to escape directly out of the roof space.

Reid provided extremely comprehensive instructions for the successful operation of the system. These run to about 12 pages, approximately A2, and include almost 50 diagrams of the necessary arrangements. They are a veritable 'Building Handbook' and must say something about Reid's pride and satisfaction in the building since there was no equivalent publication for Parliament. They include reference to the importance of regular (and recorded) maintenance, guidelines on the most economic modes of operation for different occupational requirements, hints on how to make maximum advantage of the thermal capacity of the vaults under the Great Hall, a recommendation that a log be kept of the settings required to provide equitable conditions for different numbers and patterns of occupancy and even a detailed specification of the person who should be put in charge of ensuring the correct operation for optimum comfort and energy efficiency.

'Those who may in future have to direct the ventilation of this great building, are presumed to have given evidence of their having paid special attention to the subject of ventilation; and the more they may have attended questions of practical chemistry bearing on warming and ventilation, as well as to natural philosophy, architecture, apparatus and machinery, the more eligible they must be considered for the appointment in question' (Reid, 1855).

Reid goes on to say that after this person is appointed and has familiarised himself with all the diagrams in the manual and the principles in his book 'Illustrations of the Theory and Practice of Ventilation' (Reid, 1844), he will only achieve satisfaction for the occupants with skill and delicacy. 'And for this purpose he cannot, at first, too often take his seat in every place when the apartments are crowded, from the Judge's bench to the open stand, where an almost unlimited access is given to the public – and from the platform for speakers or performers, to the seats occupied by the audience' (1855).

Shortly after Reid produced his operation manual for St George's Hall in 1855, he emigrated to the United States.

REID'S LATER YEARS IN THE UNITED STATES

Reid was recommended by James Buchanan (President from 1857), to Montgomery Meigs, an Army Engineer, who had, since 1853, been employed on The Capitol in Washington. The project was described as an extension to The Capitol but it was at this time that the dome was added and the legislative chambers, as they exist today, were constructed. The chambers were to be designed without windows and so light and air were to be supplied by artificial means.

Meigs records in his journal (see URL address in References) in January 1855 that he was aware of the system Reid had employed in the Houses of Parliament but at that stage he appears to be referring to the Temporary House of Commons because he dismisses the practicality of using chimney draft as a motive power for the air. Steam driven fans had been installed in Parliament for the New Houses in July 1851. He refers to the cost of Reid's system at the Houses of Parliament, but remarks that the cost (£220 000) must have included the cost of the Victoria Tower, which, although used for the ventilation was not built purely for that purpose. He must have been referring here to the New Houses but seems to have been unaware of the part played in the system by St Stephen's Tower (Big Ben).

In his entry for 16th April 1856, Meigs states that he 'had another visit from Dr Reid' but it is not clear from his journal when they first met. In February 1857, Reid gave three lectures at the Smithsonian Institution in Washington all attended by Meigs. They also spent another evening together, the same month, in Professor Henry's rooms at the Smithsonian where 'we had much talk about ventilation and sound'. Professor Joseph Henry was the first ever Secretary of the Smithsonian Institution, Michael Faraday had described him as the greatest US scientist since Benjamin Franklin. He had been called upon by the Vice-President to evaluate Meigs' plans for the acoustics, heating and ventilation of the new chamber of the House of representatives, but is probably best know for his research into electricity and magnetism and for the invention of the telegraph.

In the United States, Reid again showed concern for the well-being of his fellow man and published 'Ventilation in American Dwellings' (Reid, 1858), in which he strove to enlighten the general population, as well as those designing buildings, about the health benefits of good ventilation and good sanitation. An extensive introduction to this book, running to over 30 pages, was written by Elisha Harris, Physician in Chief at the quarantine hospital on Staten Island. In this introduction, Harris praises Reid, not only for his pioneering experiments in ventilation but also for his untiring efforts in attempting to raise awareness of the importance of the incorporation of proper arrangements for ventilation in domestic as well as public architecture. Harris says 'For more than a quarter of a century, in addition to important public services, he has, in promoting improved ventilation, been an earnest advocate and projector of measures for the more universal diffusion of scientific knowledge, and its application to the arts and affairs of daily life' (1858).

In his earlier book Reid himself reported that he had organised many courses on the chemistry of daily life to schoolmasters and young persons including one at Exeter Hall for a thousand teachers, which was sanctioned by no less a body than the Education Committee of the Privy Council. He had suggested that financial support should be given to 'enable missionary teachers to traverse the kingdom, and teach schoolmasters … the great elementary truths that bear on health and length of life' (1844).

Harris lists the leading points advocated by Reid for his system of ventilation and these appear to embody the thesis of this paper. They include 'The importance in all public buildings, of providing channels for the supply and discharge of air, entirely separate and apart from doors and windows' and more specifically 'the formation of extended arrangements for supplying air from the purest accessible source; for excluding or covering local impurities; for cooling, drying and moistening the air; and for the entire and absolute isolation of the warming and ventilating power, so as to permit the latter to be used in full force in warm weather' (1858). He is defining air-conditioning here just as we might define it today, the only difference being that Reid termed it 'Systematic Ventilation'.

Reid was at one stage Professor of Physiology and Hygiene at the University of Wisconsin and eventually became one of the Medical Inspectors of the United States Sanitary Commission. He was appointed Inspector of Military Hospitals in 1863 but was suddenly taken ill and died before he could carry out any of his duties.

CONCLUSION

What began with Reid as a fascination with the chemical make-up of fresh air and of expelled air, developed into a vocation to improve conditions in large public buildings as well as dwellings.

He provided a means of calculating the amount of fresh air needed according to occupancy, based on extensive experimentation and measurement. He demonstrated that humidification of the air was essential in winter for comfort. His recommendation was that there should not be a wet-bulb depression of more than about 4^oF (about 2.2^oC) in habitable spaces.

Harris reports (1858) that noticeable improvements in health of patients was demonstrated in any hospital where Reid's system was adopted. He made significant differences in hospitals in Chicago and New York in addition to systems he had supervised in Copenhagen and Lambeth (London). At the request of the Government, Reid provided plans for ventilation for the Chemical Schools at Alexandroski near St Petersburg. The Tuileries and the Palais Royal in Paris were examined by Reid and he reported methods for improvement. His suggestions were adopted in the Chapel Royal of St James's Palace as well as Buckingham Palace and Windsor Castle. Other famous buildings where Reid's Systematic Ventilation was adopted included the London Opera House, the Old Bailey and Brighton Pavilion. He also designed a ventilation system for the Royal Yacht 'Victoria and Albert' as well as a hospital ship bringing back wounded from the Chinese War and Reid goes into considerable detail (1844) about how the steamships used for the Niger Expeditions were ventilated to his design.

Space and time do not permit the consideration in detail here of many of the buildings where Reid's system was adopted. According to Harris 'A distinguished architect, who has introduced the plans of Dr Reid in the construction of forty-eight public and private edifices erected under his own supervision, testifies that the continued use of Dr Reid's ventilation scheme gives daily increasing satisfaction' (1858). Similar comments were made by a member of the Committee for the Improvement of Prisons, when Reid's (prison) ventilation system was introduced and yet Major Joshua Jebb has always been credited with revolutionising the ventilation and warming of prisons.

This paper has demonstrated that air-conditioning, as we might define it today, existed in the United Kingdom in the middle of the Nineteenth Century, that Dr David Boswell Reid was probably the first air-conditioning engineer and St George’s Hall was probably the first air-conditioned building **(Fig.14 & 15)**.

Figure 14. The Great Hall, St George's Hall, Liverpool

Figure 15. Commemorative Plaque

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