Building Engineering Services
HERITAGE REVISITED
Part 10

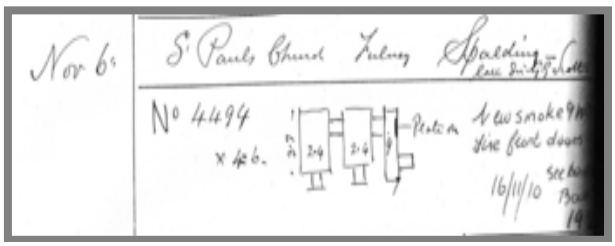
Frank Ferris
the CIBSE Heritage Group

A purpose made brass wall plaque commemorating the gift by the Parishioners of Shipham Somerset of a new heating system for St Mary's Church

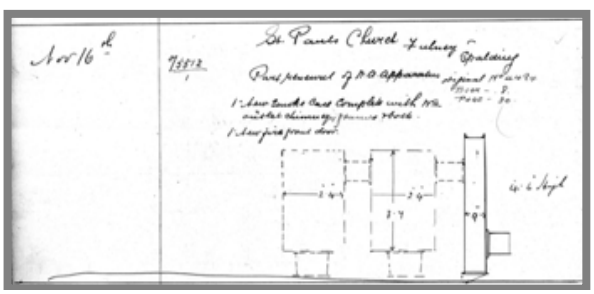
ST PAUL'S SPALDING LINCOLNSHIRE

The foundation stone for the church of St Paul as laid in October 1877 and completed in 1879. It was designed by the eminent architect Sir George Gilbert Scott who often used the heating firm G N Haden of Trowbridge in Wiltshire to carry out the heating design and installation for these churches, which included St Paul's Church, Spalding

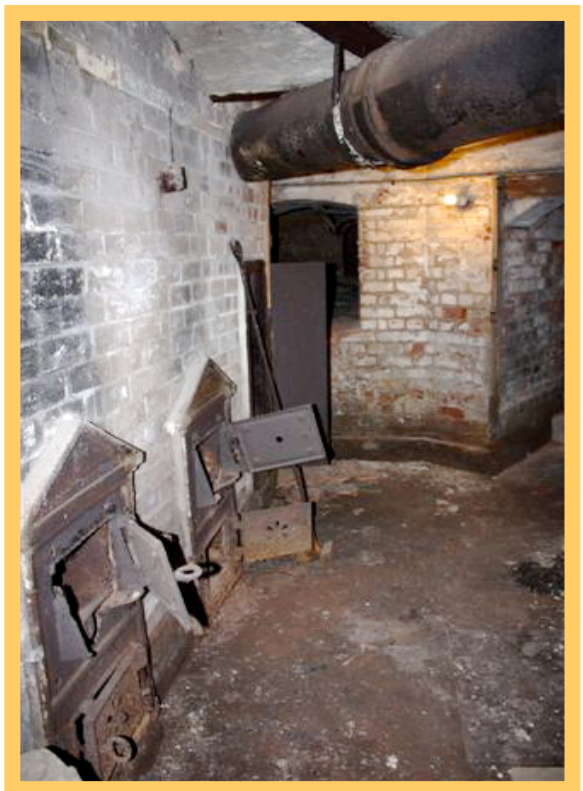
The firm of Haden has its own Archive of historical records and memorabilia held in the Wiltshire Record Office, so research was carried out to check in the original record order book for 1879. This showed that the two stoves were ordered on 6th November 1879 and given the number of 4494.



The stoves were refurbished in 1910 by the fitting of a new smoke case complete with mild steel outlet chimney, frames and bolts. The remedial work was entered 16th November and given the order number 5512.



The warm air stove and its arrangement of large builders-work air ducts were integrated into the design of the building structure for the church. These large builders air ducts were routed underground to distribute the warm air into the Church through eight cast iron floor gratings. These gratings are all positioned in the aisles to the front of the church.



General view of the furnace room

Front view of Haden stove front plates

Lapel badge presented to the G N Haden & Sons workforce to commemorate the visit of Queen Mary in 1941 during her visit to the Trowbridge works to thank and give encouragement to the workers producing munitions for the war effort

INTRODUCTION

Heritage Revisited Part-10 January 2021 continues the theme of its predecessor Part-2 July 2020, and features a diverse selection of the historic building engineering services, discovered by Members of the CIBSE Heritage Group and portrays the variety of heating and ventilating equipment installed in Religious Buildings, Country Houses, Civic & Private Buildings by some of our industry pioneers primarily during the Victorian & Edwardian Periods.

CONTENTS

ST FAITH'S OVERBURY WORCESTERSHIRE

St Faith's is an unusual name for a church and one of only 33 churches with similar names to be found in this country. The church is built from warm colour Cotswolds stone and is located on the southern side of Bredon Hill in the Worcestershire countryside. The church was designed by the eminent Architect R Norman Shaw Esq. and the warm air heating system was most likely installed at the same time it had its Victorian restoration in 1880. Its claim to fame is that it had still retained one of the very few remaining G N Haden & Sons Ltd warm air stoves. The stove was first installed in 1879, and then had remedial and replacement works carried out in 1946.

The warm air stove and its arrangement of large builders work air ducts were designed and integrated into the fabric of the building structure for the church.

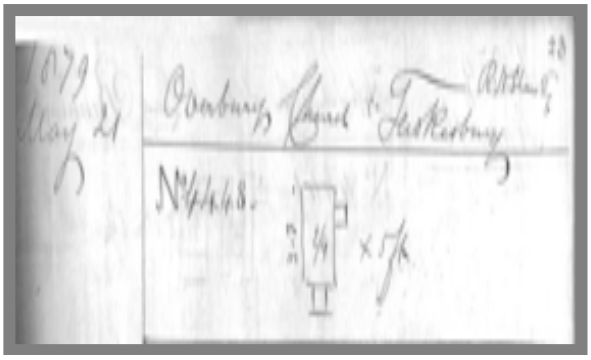
The large builders air ducts were routed underground to distribute the warmed air into the Church through cast iron floor gratings.

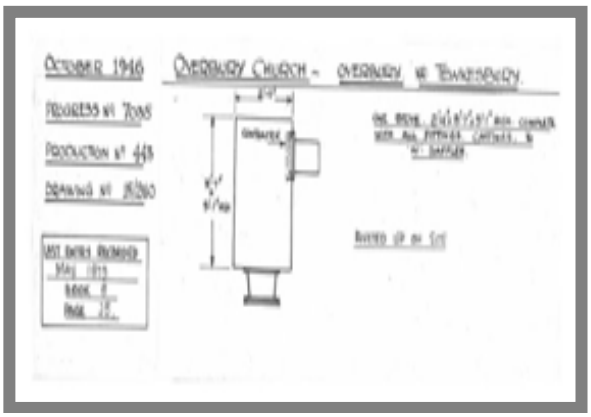
These floor gratings are positioned in the aisles towards the rear of the church.

The warm air stove front plate in its original position with a cleaning tool

Research carried out at the Haden Archive held by the Wiltshire Record Office in Chippenham showed in the original Order Book for that time period that the stove was a size No 2 and given the number of 4448 with an entry date of 21st May 1879. Every Haden stove installed was given its own unique number.

Remedial and replacement work was carried out to the stove in October 1946.





The front plate of the stove was removed in 2005 and transported to Australia where it was restored, and then displayed in the Sydney, New South Wales offices of Haden engineering pty.

ST MARY the VIRGIN LANGHAM ESSEX

The Parish Church of St Mary the Virgin in Langham Essex is sited on the Langham Hall Estate The church dates back to the 12th Century with additions of the south aisle in the 14th century. Major Victorian restorations were carried out in 1861/63 and the 1890's. The tower was damaged by fire in the 1870's and was later reconstructed. The Church was given a Grade 1 Listed building status in 1965.

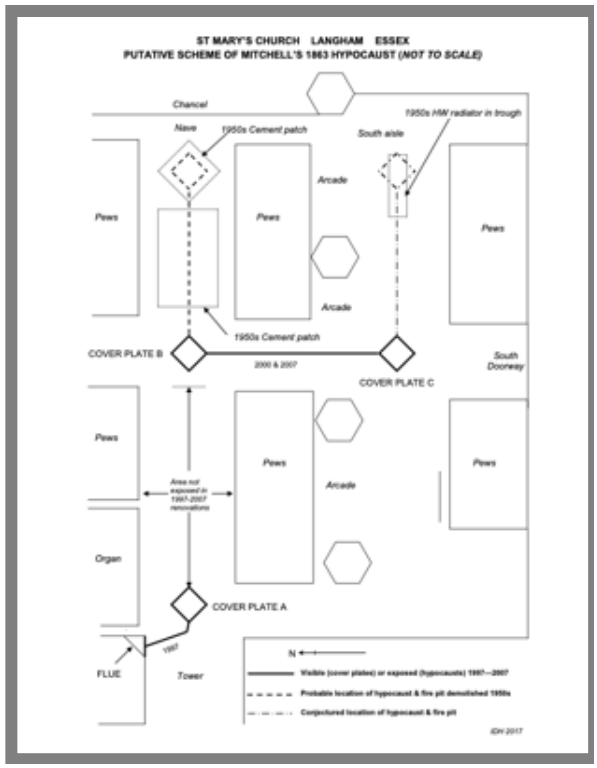
The Chelmsford Chronicle edition of 6th November 1863 makes reference to the parish church being heated on Mitchell's principle installed during the church's Victorian restoration completed in that year.

The Roman Hypocaust heating system was the method that they used when they warmed their Villas and Bathhouses. The Roman Hypocaust had a furnace which circulated the combustion hot flue gases through floor voids and thence through ducts or chimneys built into the walls to rise up and exit to atmosphere. The hot flue gases heated the solid floors and walls which then radiated their heat into the space to be heated.

The heating system in St Mary's uses a similar method but has 'hot-fire pits' built in the aisles that house the furnaces. Underfloor flue ducts from the fire pits are used to remove and transfer the hot flue gases before dispersing them up through a tall chimney located within the Tower. Five hot-fire pit furnaces in the floor constructed from brickwork are built in the aisles with their underfloor flue ducts traversing the floors conveying the hot flue gases to the chimney.

St Mary's in Langham is the only church currently known in Essex to have installed the most commonly found underfloor Hypocaust warm air heating system that is related to Mitchell's principle.

This Hypocaust underfloor warm air heating system is similar to the installations found in St Margaret of Antioch Church in Wellington, Herefordshire, St Michael & All Angels Church in Ufton Warwickshire and St James the Apostle in Wigmore Herefordshire.



Built into the floor of the various aisles in the Nave were five cast iron floor plates each approx. 400mm square with a centre lift out section. Each floor plate covered a deep pit, with a firebrick lining forming the sides of each pit.

The diagrammatic layout shows the most likely route of the underfloor flue ducts connecting with the other fire pits before entering the vertical flue/chimney.
The purpose for these various floor pits was for use as the hot fire pits acting as furnaces for the Hypocaust warm air heating system.

The wording on the remaining floor cover plate

Mitchell's Patent
Reverberating Smoke Consuming
Hypocaust for Warming
Churches

Millennium stone in approx position of original cover plate C

Underfloor flue ducts from cover plate A to Tower North Wall (exposed in 1997)

Underfloor flue ducts from cover plate A to Tower North Wall (exposed in 1997)

Underfloor flue ducts from cover plate A to Tower North Wall (exposed in 1997)

The arrow indicates the position of the angled quoin locating the likely position of the hypocaust A metal plate now covers the top of the quoin / chimney. The original chimney must have been much higher built against the wall of the tower but has since been demolished.

BROWNLOW HOUSE
LURGAN
NORTHERN IRELAND

Brownlow House was built in 1833 for the Rt Hon Charles Brownlow later to become Lord Lurgan. In both wars WWI and WWII the house was used by the military to station troops. During WWII British and American troops were stationed at the house and it was said that the Supreme Allied Forces Commander General Dwight D Eisenhower also stayed in the property.

The Basement of the House has recently been refurbished and converted into an Eisenhower Museum and it was during the renovation building works when it became necessary to demolish certain walls, that two warm air stoves manufactured and installed by G & J Haden of Trowbridge Wiltshire were uncovered.

What made this discovery very important is the time of the installation in the1830's This is the early years when George & James were establishing the quality of their work and it is therefore likely that these stoves were installed by James Haden.

The two warm air stoves had been installed in the Basement with brickwork ducts constructed under the ground floor rooms transferring the heat into these rooms through grilles fitted in the skirting boards.

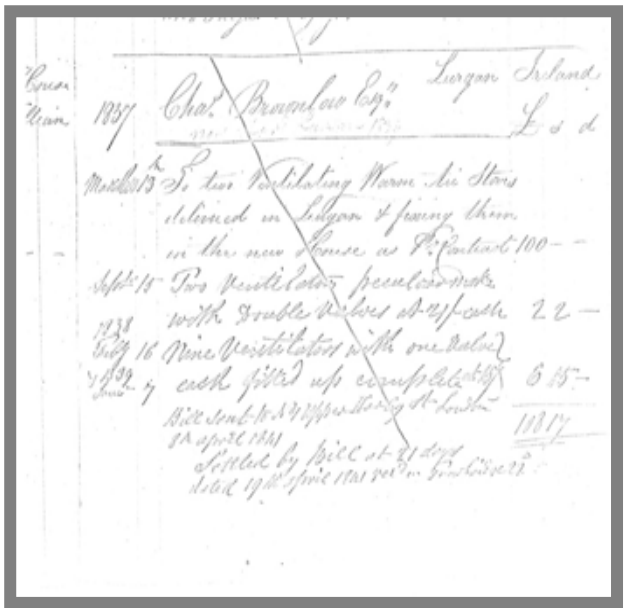
The furnace chamber of each stove is of rivetted construction. Noting that both the side panels have finned extension fins or plates which fit tight to the adjoining brick walls. The fins were fitted to increase the heated surface area to maximize the transference of furnace heat into the warmed air.

View looking from adjacent corridor after the wall had been removed

Left hand side

Right hand side above firing door

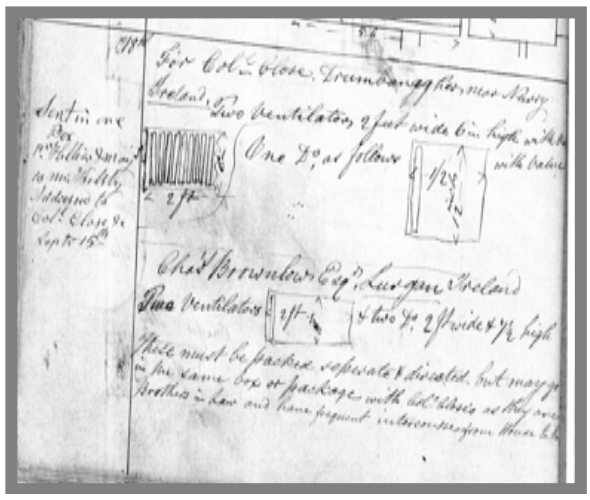
Every Haden stove manufactured during the 1800's carried its unique number so a search was made in the firm's original order books to establish the date of the installation and any other salient information. The Haden firm is a rare example of a Heating & Ventilating company that has retained an archive of its historical memorabilia. This is held on deposit at Wiltshire History Centre in Chippenham. No entry was found in the order books relating to the Brownlow House stoves. However, a check of the early account books did reveal two entries that gave the cost of the stoves and ventilators.



the notes say,
1837 Chasl. Brownlow Esq" Lurgan Ireland

March 13th To two Ventilating Warm Air stoves delivered
in Lurgan and fixing them in the new house as per contract £100 - -
Sept 18th Two ventilators peculiar to works with double valves at. 21/- each. £2-2-0
- 2 -
1838 February 16th Nine ventilators with one valve each fitted up complete at 15/- £6-15-0

Bill sent to No 1 Harley Street London 8th April 1841
settled by bill at 21 days dated 19th April 1841
received by Trowbridge on 22nd.



the notes say, Chas' Brownlow Esq" Lurgan Ireland two Ventilators 2ft x by two ditto 2ft wide x 11/2 high

These must be packed separate as directed but may go in one box or package with Col' Close's as they are Brothers in Law and have frequent intercourse from house to house.

During 1996 several arson attempts were made on the building but one attack on 30th August resulted in the destruction of most of the building. When the building was restored, the renovation works removed most of the original low-level warm air ductwork and the ventilators. Only one example of the ventilator grilles now remains in its original skirting board location.

The ventilator grille shown above is the single valve pattern

The Ventilator Grille shown above is the double valve pattern

ST DENY'S ASWARBY LINCOLNSHIRE

The Parish church of St Denys is Listed a Grade 1 structure, which was restored with a rebuilt chancel during the Victorian period 1847 - 1850 by Edward Blore. It is most likely that during this restoration the floor pit and chimney were constructed for the installation of the saddle type boiler and the heating system.
This is a very rare example of a historically important saddle type boiler that is still in situ.

Face-on view showing the saddle boiler with the fire-grate and ash pit below

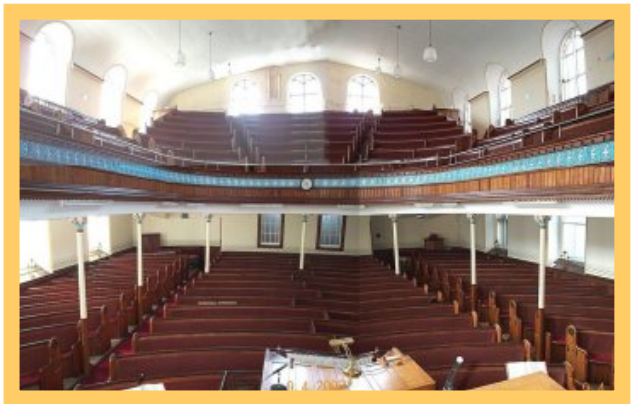
Angled view showing the 3 soot clean-out doors

View into floor-pit facing the furnace. Note the pipework partially buried in the floor on the right-hand side

View into floor-pit facing the rear vaulted coal storage area.

BETHLEHEM CHAPEL TREORCHY SOUTH WALES

This Chapel is one of numerous religious buildings of all denominations built in South Wales during the second half of the 1800's which were heated by Perkins HPHW pressurised & sealed heating systems.



Original chapel was built on this site in 1869 and rebuilt to its present size in 1881.

Most Chapels unlike the majority of Church of England buildings are constructed with internal tiered balconies. Bethlehem Chapel is heated by a three-circuit endless loop system which has additional pipe circuits routed around the front and sides of the balcony. Unlike the single storey churches this arrangement with pipework at two levels made it necessary for special air vent fittings to be installed at the upper level to allow the pipework to be flush vented upwards from the bottom of the system.

A purpose Perkins HPHW made air vent complete with connecting sockets for a pressurised heating system

View showing Perkins air vents fitted in both pipes

The inability of present-day heating firms to understand the basic principles of a Perkins sealed and pressurised heating system is made all-to clear with this installation. Small size air vent cocks have been drilled and tapped into the hydraulic tubing so that the pipework could be air vented after repairs were carried out to the system to correct a water leak. That these air vent cocks have been fitted next to the Perkins system's own purpose made air vents shows a lack of knowledge and judgement which has completely destroyed the integrity of the hydraulic quality tubing. This heating system therefore is no longer a true Perkins pressurised system but remains in name only.

View at floor level of expansion loop in pipework

The pipework in the ground floor aisles was installed at floor level and formed closely around any obstructions such as columns and plinths.

Two equi-size expansion pipe vessels are fitted at the system's highest point complete with the top-up and venting connections.

Due to the very high operating pressures and temperatures of the Perkins systems, very long adjustable spanners were needed to securely tighten these plugs.

CULZEAN CASTLE AYRSHIRE SCOTLAND

During the 1800's the use of towns gas for lighting was becoming very popular and the aristocracy and landed gentry were keen to ensure that this new method of lighting was used in their own stately homes. Many stately mansions that were refurbished and modernised during Victorian times had their own small gas making plant built on the property.

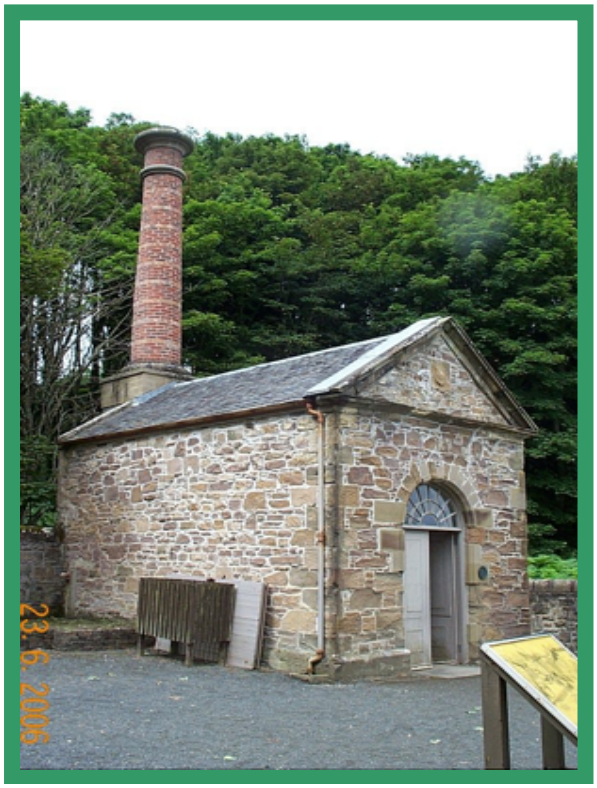
One stately home in Ayrshire, Culzean Castle that is now owned by the National Trust for Scotland has completely restored the original buildings of the small gas making plant which had slowly become derelict over the last 50 years.

The Castle built at the cliff edge overlooking Culzean Bay was an ideal location where a small gas making plant could be built, sited adjacent to the beach where small "puffer" boats could deliver the coal (which was used to make the gas) right up to the shore, keeping the handling of the fuel to a minimum. The gas plant sited at beach level was also then out of sight to the owners of the Castle.

This artist's impression on an information board shows how the gas works would have looked in the 1880's with a small boat offloading the coal into a waiting horse and cart.

The coal was then taken up the beach into the yard to be stored until used. The Retort House (with the chimney) needed to be worked 24 hours every day to maintain a sufficient quantity of gas to fill the gas holder and also supply the needs of the Castle. The Gas Managers House was the building where the people lived who worked in the retort house.

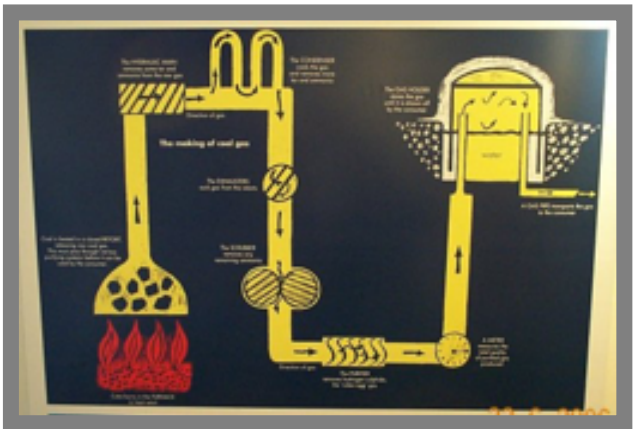
THE RETORT HOUSE



Inside the Retort House

A full-size realistic model has been constructed to show what the working layout would have been like inside the Retort House.

The actual conditions for the workers with the intense heat, smell, and dirt when feeding the retorts with coal can only be imagined and therefore never fully appreciated.



A diagrammatic colour layout showing the creation of town gas from coal. Each stage in the manufacturing process is identified before the gas can be stored and prepared ready to be fed up pipes for use in the Castle.

All that remains of the gas holder is the pit.

To recognise the achievement of the refurbishment of these buildings, this restoration project was awarded the Europa Nostra Award in 1992

The number of gas works in Scotland grew, reaching a peak in the 1840's; several however, closed in between the two World Wars. The 1948 Gas Act set up twelve Area boards (including the Scottish Gas Board) and by that time there were 195 works producing town gas in Scotland, from Lerwick in the north to Kirkcudbright in the south.

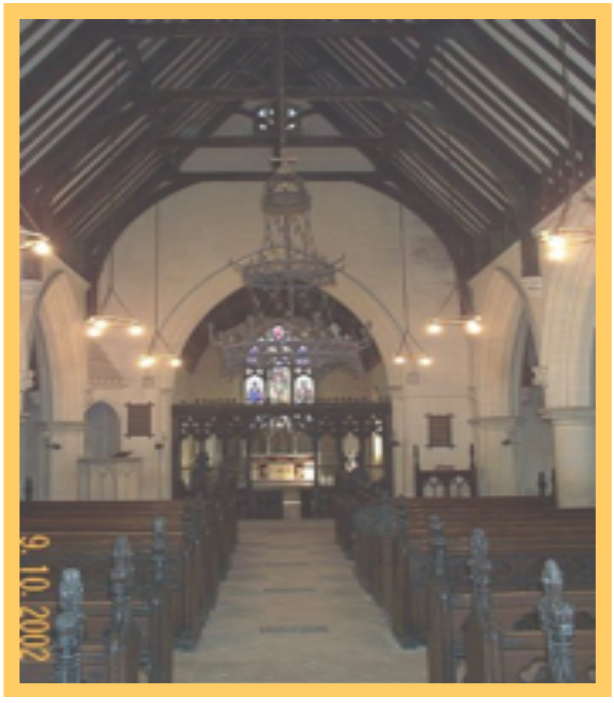
The Biggar Gas Works has been preserved by the National Museums of Scotland and is open to visitors.

ST SAVIOUR'S TETBURY GLOUCESTERSHIRE

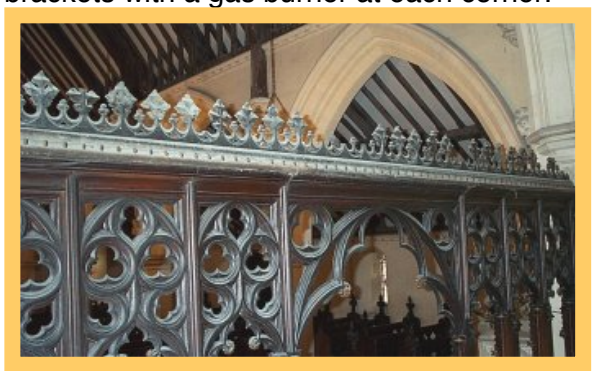
St Saviour's Church was built and consecrated in 1848 as "a little church for the poor". The Parish Church in Tetbury had a scarcity of pew seats for renting which prompted building a second church.

The church was declared redundant in 1973. and is now under the care of The Churches Conservation Trust.

The fact that the church became redundant is the probable reason why the original gas lighting installation has remained mostly untouched.
Although the gas installation is no longer in use, the majority of the wall brackets (some still with their glass shades), a pendant gasolier, and most of the distribution pipework are as they were when originally fitted.



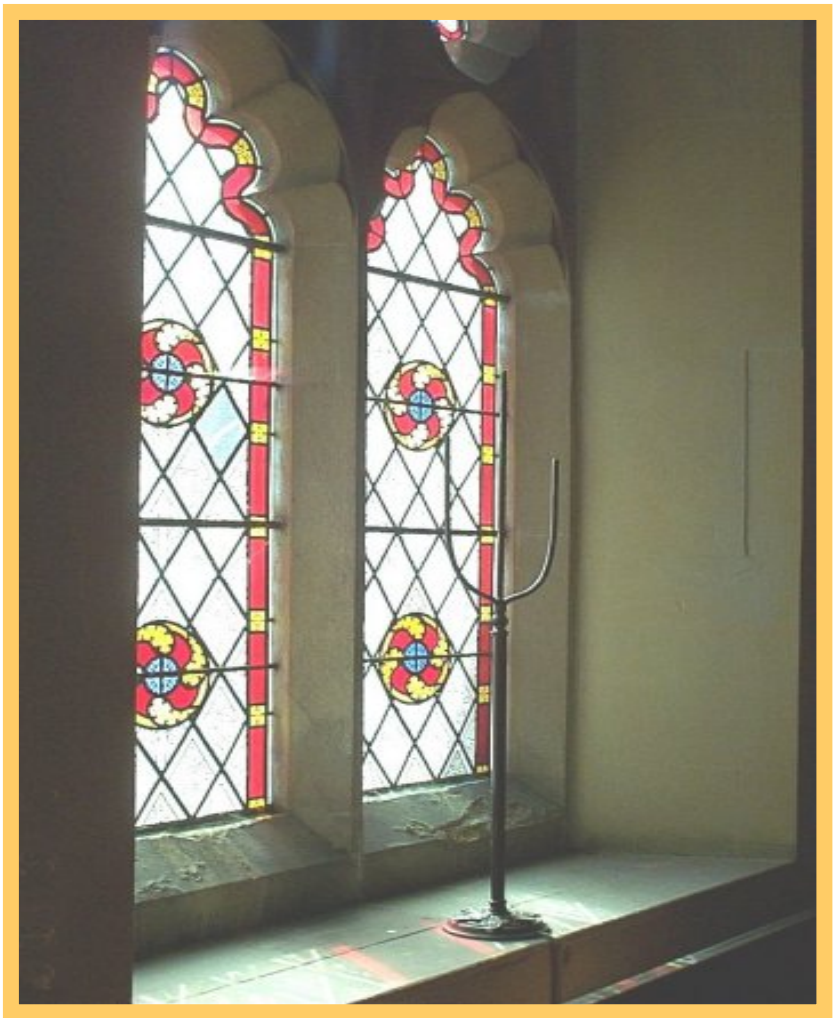
Hanging above the centre aisle of the Nave is a **Corona Lucis Gasolier** by Hardman. It comprises two octagonal shaped framed brackets with a gas burner at each corner.



Of particular interest is a gas burner bar which has been fixed to the top of the timber Rood Screen which separates the Nave from the Chancel.

There is an abundance of small gas jets on the top of the burner bar as can be seen in the picture below. It must have been a wonderful awe-inspiring sight to have seen all these gas jets alight in the darkness.

Fixed to the cill of the window in the Chancel is what remains of a trident standard gas light, with its connecting gas pipe.



There are several hinged bracketed gas wall lights (some still fitted with their glass shades or globes) which are connected to the small diameter piping which supplied and fed them.

WIGHTWICK MANOR WOLVERHAMPTON

The Manor was built in two phases at different times. The West Wing built in 1887 was extended to include the East Wing in 1893. It is a Grade I Listed building designed by Edward Ould of Liverpool and built for Theodore Mander. The Mander family were industrialists in the west Midlands area. The property was given to the National Trust in 1937.
The West Wing central heating installation was a Perkins MPHW system complete with a brickwork furnace. The system which comprised 5 circuits was installed by John King Limited Liverpool. There is an obvious connection between John King Limited and the designer Edward Ould both from Liverpool.

CAUTION. —*Some persons profess, and lead the Public to believe, that they have put up Heating Apparatuses for Royalty, &c., whereas they have never received any such orders; they are, therefore, making false representations.*

JOHN KING LIMITED,

Heating and Ventilating Engineers,

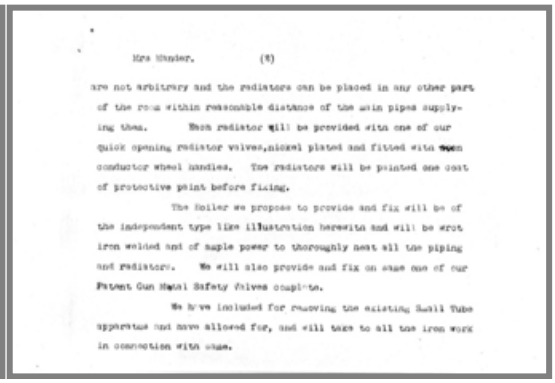
Patronised by
H.R.H. THE PRINCE OF WALES, &c.
HIS GRACE THE DUKE OF SUTHERLAND.
HIS EMINENCE CARDINAL MANNING.
H.M. OFFICE OF BOARD OF WORKS.
THE LIVERPOOL GENERAL POST OFFICE.
THE MERSEY DOCK AND HARBOUR BOARD.
ALFRED WATERHOUSE, ESQ., R.A.

Manufacturers of King's Patents,

BENSON STREET,

LIVERPOOL.

ESTIMATE NO. 1 16th. July 1904



Mrs Mander. (2)

are not arbitrary and the radiators can be placed in any other part of the room within reasonable distance of the main pipes supplying them. Each radiator will be provided with one of our Quick opening radiator valves, nickel plated and fitted with ~~wood~~ conductor wheel handles. The radiators will be painted one coat of protective paint before fixing.

The Boiler we propose to provide and fix will be of the independent type like illustration herewith and will be wrot iron welded and of ample power to thoroughly heat all the piping and radiators. We will also provide and fix on same one of our Patent Gun Metal Safety Valves complete.

We have included for removing the existing Small Tube apparatus and have allowed for, and will take to all the iron work in connection with same.

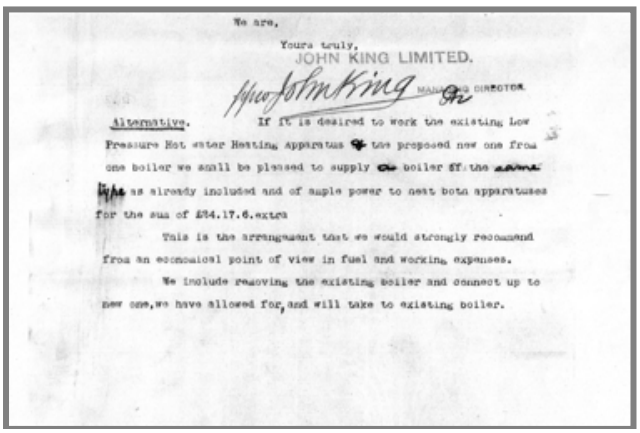
To Mrs Mander.
Wightwick Manor Wolverhampton.

Madam,

We will provide and fix our IMPROVED HOT-WATER HEATING APPARATUS in Wightwick Manor containing altogether equal to 5000 — feet of 4" Piping, for £ 280-15-0 —, to be fixed as follows, and as shewn upon the Plan hereunto. The Piping will be of wrot Iron best quality with screwed joints and of the best quality of cast iron with caulked joints and will consist of about 300 ft of 1" and 170 ft of 1¼" wrot piping and 150 ft of 3", 840 ft 3", and 90 ft 4" cast piping and 58 of our ornamental Panned Radiators as per illustration No. 83 herewith containing altogether equal to 560 sq.feet of heating surface.

The larger sizes of piping will be in the form of mains to the various rooms and will be fixed under the floor, and the smaller sizes of wrot iron pipes will form connections from the mains to the Radiators in the rooms.

The Radiators will be placed in the positions shewn on plan herewith or as near thereto as circumstances will permit, but the positions



We are,

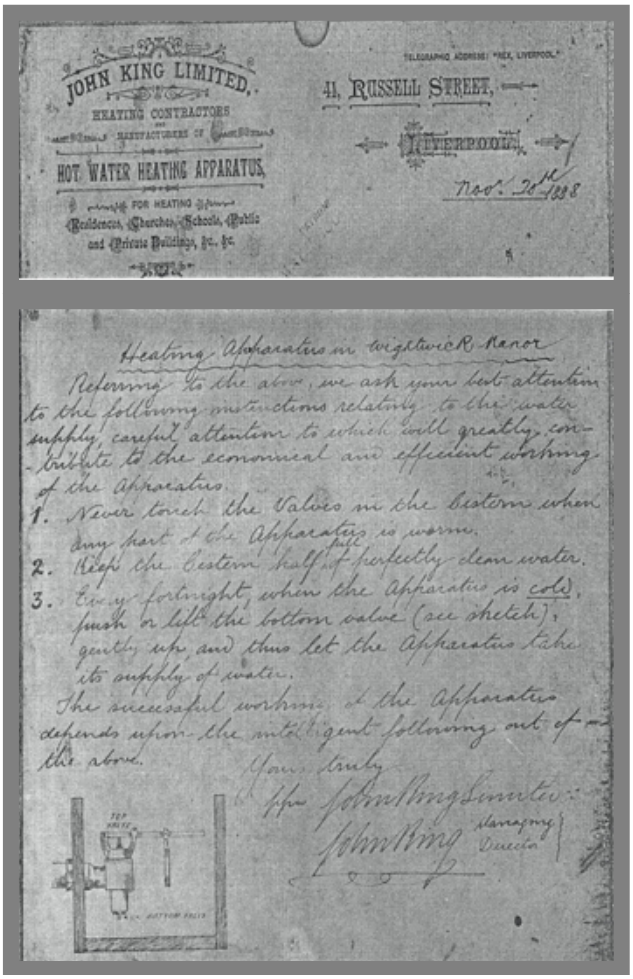
Yours truly,
JOHN KING LIMITED.
MANAGING DIRECTOR.

Alternative. If it is desired to work the existing Low Pressure Hot water Heating Apparatus to the proposed new one from one boiler we shall be pleased to supply one boiler for the same as already included and of ample power to heat both apparatuses for the sum of £34.17.6.extra

This is the arrangement that we would strongly recommend from an economical point of view in fuel and working expenses.

We include removing the existing boiler and connect up to new one, we have allowed for, and will take to existing boiler.

As a medium pressure system (MPHW) it was fitted with a water cistern and integral pressure balancing valve that allowed the heated water in the pipework as it expanded, to spill into the water tank. When the water in the system had cooled the pressure valve would open and allow the water in the cistern to re-enter the pipework. It was necessary to occasionally manually top up the system water by opening the counter-weight on the balancing valve. This operation could only be carried out when the system water was cold.


JOHN KING LIMITED,
HEATING CONTRACTORS
HOT WATER HEATING APPARATUS
41, RUSSELL STREET,
LIVERPOOL.
Nov. 26th 1898

Heating Apparatus in Wigstwick Manor

Referring to the above, we ask your best attention to the following instructions relating to the water supply, careful attention to which will greatly contribute to the economical and efficient working of the Apparatus.

1. Never touch the Valves in the Cistern when any part of the Apparatus is warm.
2. Keep the Cistern half full of perfectly clean water.
3. Every fortnight, when the Apparatus is cold, flush or let the bottom valve (see sketch) gently up and thus let the Apparatus take its supply of water.

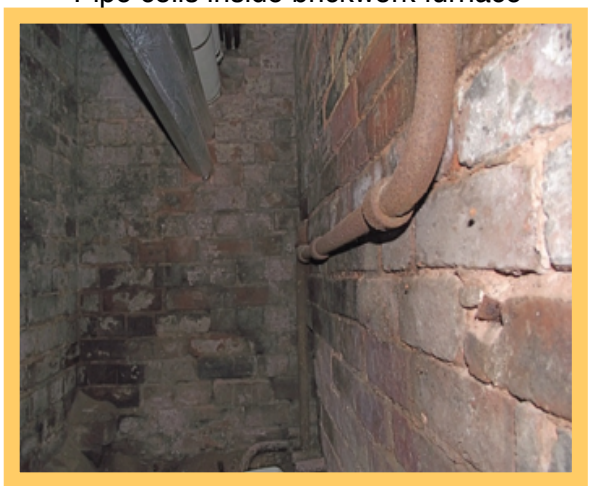
The successful working of the Apparatus depends upon the intelligent following out of the above.

Yours truly
pp John King Limited
John King Managing Director

The Perkins system pipework that still remains in the rooms is mainly hidden behind grilles /gratings in the bay windows and took the form of sinuous coils. The small amount of pipework in each room made it most probable that it only provided a background level of heating.


John King Limited Liverpool furnace nameplate


Pipe coils inside brickwork furnace


Pipe circuits on side of furnace brickwork


Pipe circuits on top of brickwork furnace

At a later date most of the Perkins system pipework was removed presumably to allow space for the next wet heating system to be installed. Correspondence dated 1910 shows that another improved wet heating system was installed by the firm of Killick& Cochran Liverpool.

The East Wing built 1893 originally had Killick & Cochran's own cast iron sectional heaters installed in the Ground Floor area. Several of their sectional heaters are still connected to the current pipework system. These heaters are an early pattern of cast iron heater that had their sections bolted together.

FRESH AIR VENTILATION

Most of the family's main and ancillary rooms in the West Wing are fitted with 'Tobin' tubes which introduced ducted fresh air into the room. Tobin tubes are connected to the outside and fitted with damper control to regulate the amount of fresh air required.

This tube has been carefully concealed within the timber and wallpaper. The timber top frame is evidence of its position

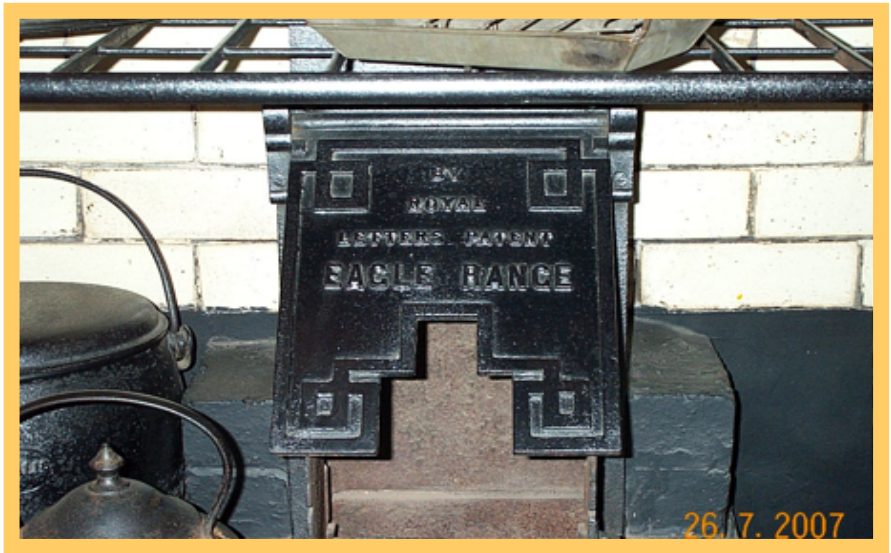
This tube has been hidden behind the timber panelling. The top of the tube is at the level of the timber moulding. Note the careful concealment of the control damper.

TOWEL RAILS

The central domestic water supply has been removed and is now provided by 'point of use heaters'.

However, towel rails constructed from copper tubing and fittings are still fitted in bathrooms. They are all an interesting design feature dating from the Victorian period.

KITCHEN EQUIPMENT

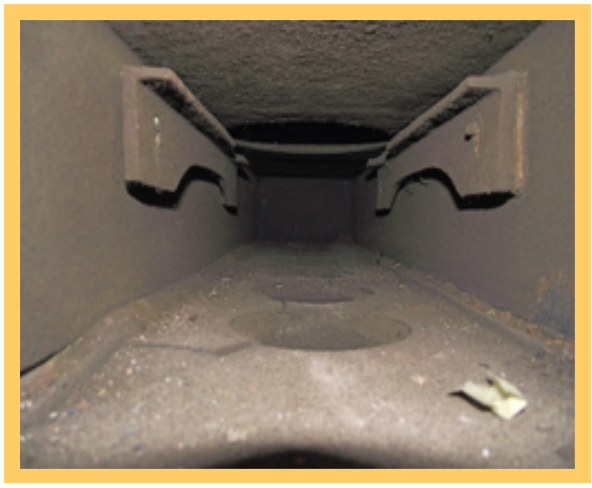


Both Kitchen Ranges are manufactured by the
Eagle Range & Gas Stove Co Ltd, Aston Cross, Birmingham

TURKISH BATH

The Turkish bathroom was heated by a Constantine convoluted pattern warm air stove. The stove is sited in the basement and is of 'built into brickwork' design.

The hot air would enter the room through the grille fitted in the top of the tiled brick tower.



View taken inside top flue header chamber showing outlets from combustion chamber below and single chimney outlet above.

ST MARY'S NEWENT GLOUCESTERSHIRE

St Mary's Church dates from the Normandy period and was enlarged during the 13th and 14th centuries. The church lays claim to the longest unsupported wooden ceiling in the country.

The heating system dates from the late Victorian period and was installed by A H Skinner from Bristol. This firm separated from the previous firm of Skinner Board in 1894 when it split into two firms, Skinner Board & Co and A H Skinner & Co. They had their own ironfoundry at 106 Stokes Croft Bristol where they cast boilers, pipe coil heaters, pipework and special shaped pipe fittings.

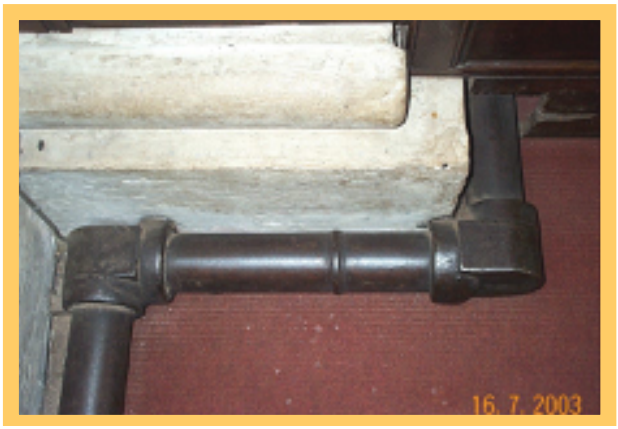
The wording on the nameplate
A H SKINNER & CO HEATING ENGINEERS
STOKES CROFT BRISTOL

A selection of the different size box-ended pipe coil heaters

It can be seen from the various shapes and sizes of the box end pipe coil heaters how they were purpose made to fit the location where they were to be installed. Also note the purpose made bottom side outlets with right angle wheel valve.

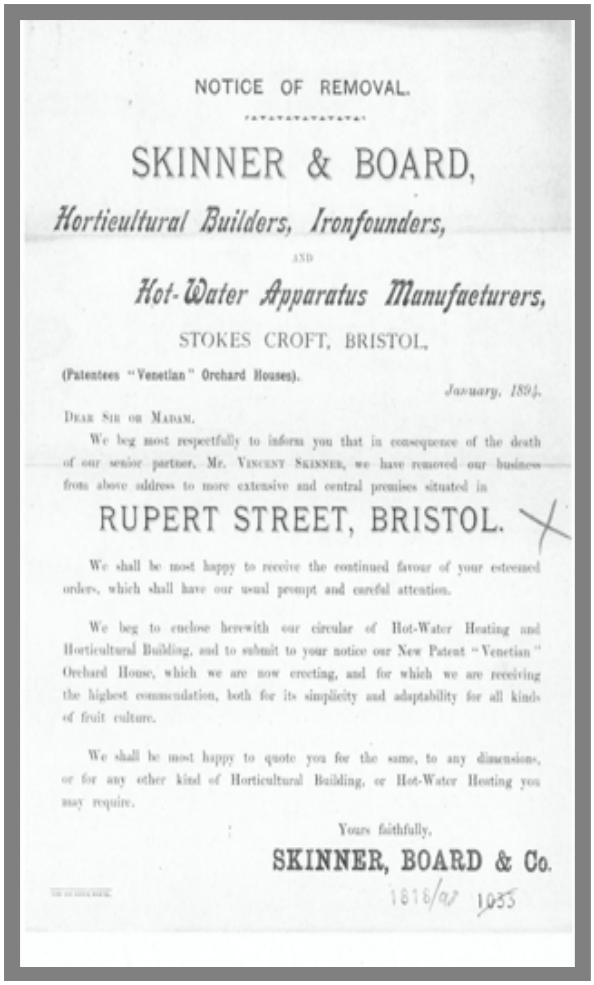
The Skinner trade-mark for their box-ended pipe coil heaters was the rounded tops with a Gothic shape at the top of the end header.

A selection of the cast iron pipe fittings in the heating system



Note the right-angle elbows and concentric reducer.

There appeared to be no brackets or supports for the pipework which just rested on the floor.



NOTICE OF REMOVAL.

SKINNER & BOARD,

Horticultural Builders, Ironfounders,

AND

Hot-Water Apparatus Manufacturers,

STOKES CROFT, BRISTOL,

(Patentees "Venetian" Orchard Houses).

January, 1894.

DEAR SIR OR MADAM,

We beg most respectfully to inform you that in consequence of the death of our senior partner, Mr. VINCENT SKINNER, we have removed our business from above address to more extensive and central premises situated in

RUPERT STREET, BRISTOL.

We shall be most happy to receive the continued favour of your esteemed orders, which shall have our usual prompt and careful attention.

We beg to enclose herewith our circular of Hot-Water Heating and Horticultural Building, and to submit to your notice our New Patent "Venetian" Orchard House, which we are now erecting, and for which we are receiving the highest commendation, both for its simplicity and adaptability for all kinds of fruit culture.

We shall be most happy to quote you for the same, to any dimensions, or for any other kind of Horticultural Building, or Hot-Water Heating you may require.

Yours faithfully,

SKINNER, BOARD & Co.

1818/97 1035

CONTRACTORS TO HER MAJESTY'S GOVERNMENT.

SKINNER & BOARD,

HORTICULTURAL BUILDERS, HOT-WATER ENGINEERS

And IRONFOUNDERS,

STOKES' CROFT, BRISTOL,

(ESTABLISHED 1858)

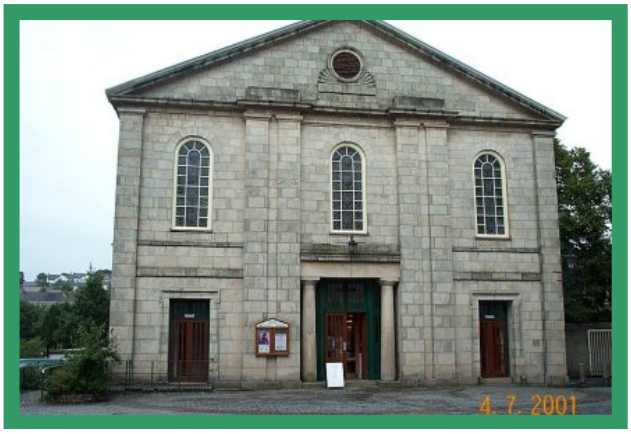
CHURCHES,
CHAPELS,
SCHOOLS,
MANSIONS,
WAREHOUSES,
SHOPS,
WARMED BY HOT-WATER.

CONSERVATORIES,
GREENHOUSES,
VINERIES,
ORCHARD HOUSES,
MELON HOUSES,
PEACH HOUSES,
ORCHID HOUSES,
ERECTED,
and WARMED by HOT-WATER

UPRIGHT TUBULAR BOILER.

A LARGE STOCK KEPT OF DIFFERENT SIZES AND POWER.

TRURO METHODIST CHAPEL CORNWALL



The Chapel was built in 1830 and designed by Mr Sambell the Architect who remarkably was unable to hear (deaf) or speak.
In its early years it was heated by a warm air stove installation. During the recent refurbishment works the underfloor builders work ducts which led from the warm air heating stove were discovered whilst the flooring was being removed. A later restoration in 1885 was by Sylvanus Trevail a local Architect.

These alteration works appear to have included the installation of gas lighting, raising the roof and the erection of a new ceiling. As the congregation at this time was in the region of 2000 this must have led to the need for a ventilation system to be installed.

Extract Ventilation System

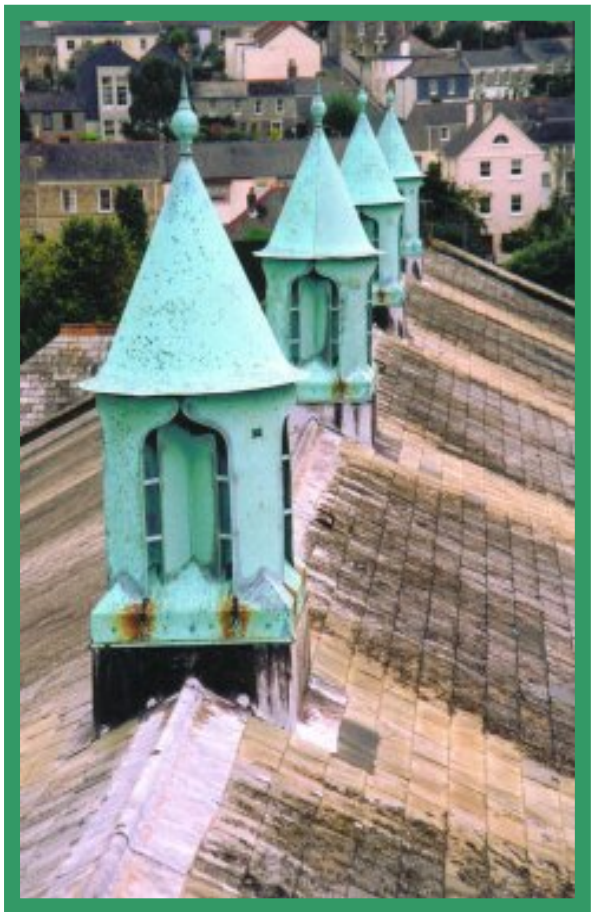
For the Chapel a new innovative type of ventilation system was installed which used the venturi effect to assist in extracting air. This passive ventilation system was installed within the roof space and used centrally sited rising air ducts to induce air from the perimeter extract ducts.

Circular grilles in the ceiling sited along the centre line of the Chapel allowed the warm air rising from the congregation and from the gas lighting to pass through and be collected by the circular hoods in the roof space sited above the ceiling grilles

This extracted air is then accelerated by the effect of a venturi whereby the ducting is decreased in cross-sectional area to increase the velocity of the air. This air increased velocity was then used to induce and draw in extracted air from the perimeter ducting in the roof space.

Fixed lengths of rectangular perimeter ducting in the roof space are each connected by circular ducting which then connects into the main riser ducts above the venturi reductions.

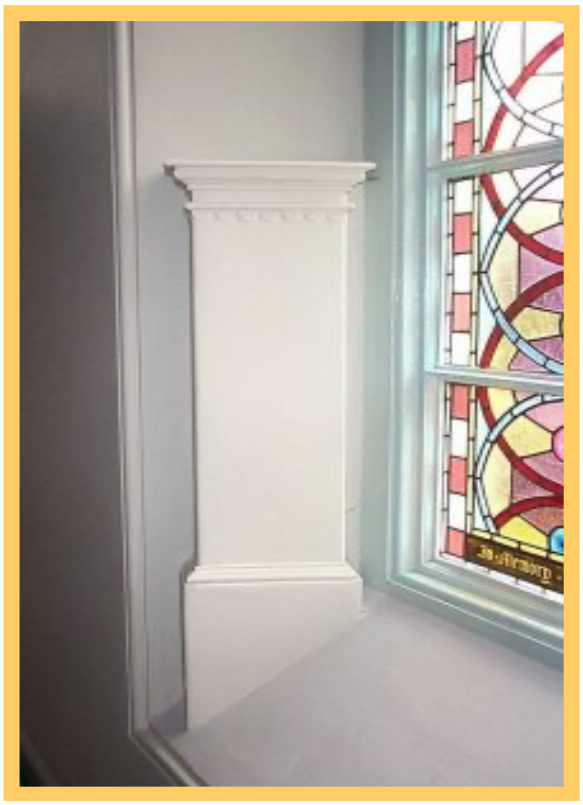
The perimeter ducting is continuous and its air inlet is connected to the decorative mouldings at the cornice edge of the building.



The vitiated air then escapes to atmosphere through circular turret vents sited along the ridge line of the roof.

During large congregations the high internal height of the Chapel helps to increase the stack effect within the building, and thus increase the quantity of the extracted air drawn into the roof ducting.

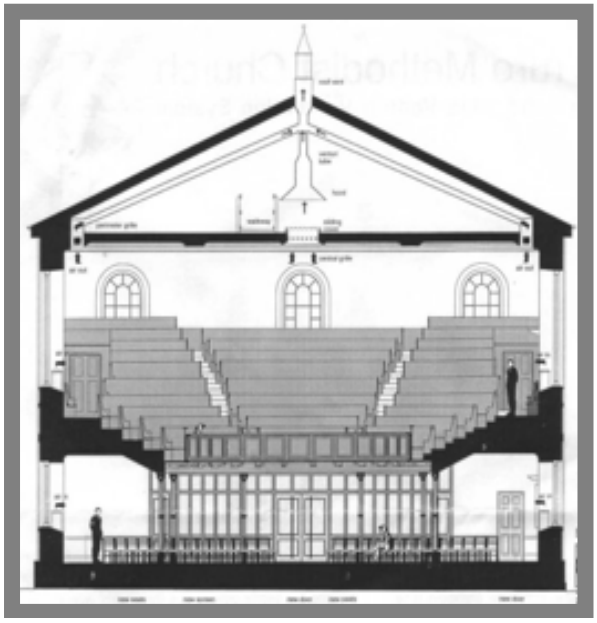
To compensate for and balance the amount of extracted air, fresh air inlet boxes (each complete with a flap control damper) are installed in the majority of the window recesses at both floor levels.



These air inlets are similar in design to the Tobin Tubes illustrated in the third edition of Walter Jones book 'Heating by Hot Water' published in 1904.

Additional Tobin tube boxes are fitted flush within the thickness of the external walls where access is restricted.

The ventilation system was effectively made redundant during the 1960's when the circular ceiling grilles were frosted over and lighting installed in their positions.



Our ancestral Victorian engineers without the benefit of electricity devised and installed an effective extract ventilation system for the Chapel which after a brief period of disuse has now been brought back again into operation 115 years after its initial installation.

ST ANDREW'S ASTON SUB-EDGE GLOUCESTERSHIRE

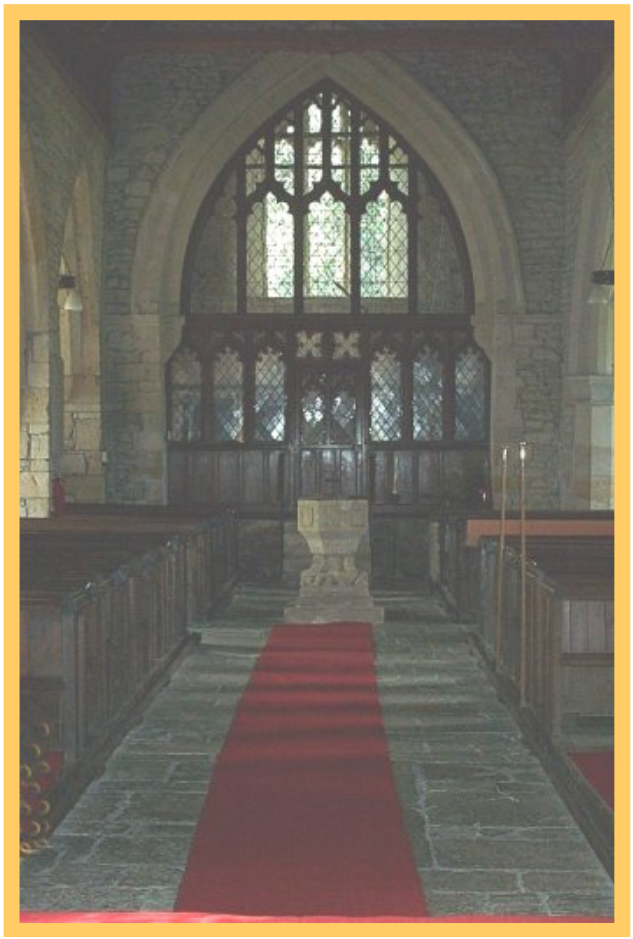
St Andrews is a delightful small church located at the bottom of the Cotswold escarpment. It is rare nowadays to discover a church of any size still fitted with its original gas heating and lighting.

The church is heated by four gas fired radiators made by Fletcher Russell & Co Ltd of Warrington. This company has an interesting history.

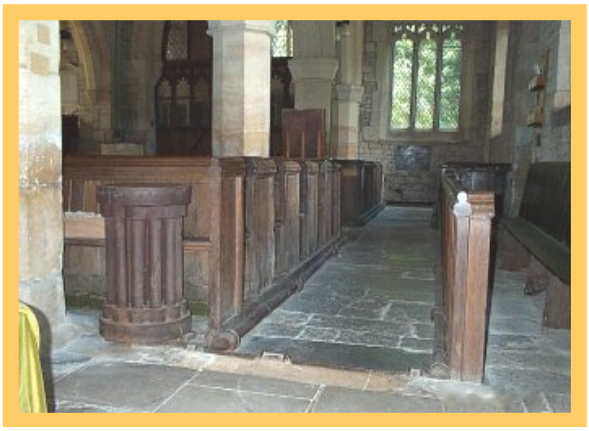
Fletcher Russell & Co Ltd were established by Thomas Fletcher (1840-1903), who began work as a dentist in Warrington. In 1865 he was listed in Cairo Street and in 1871 at 15 Bold Street. By 1876 he had moved to 4-6 Museum Street and was manufacturing dental apparatus. By the early 1880s he had added a gas appliance manufactory in Thynne Street. By 1895 the company had become Fletcher Russell and Co Gas Engineers, his firm having merged with Alexander and William Russell of Pendleton Iron Works. The 1901 directory gives their address as Palatine Works, Wilderspool Causeway, Warrington, manufacturing all types of gas equipment including fires, cookers and water heaters as well as laboratory equipment.

ST MARY'S ELMLEY CASTLE WORCESTERSHIRE

The church dates back to the 13th century whilst the heating system can be dated to around the year of 1887 Queen Victoria's Golden Jubilee.



The heating system appears to be entirely of cast iron and is a excellent example of Victorian engineering.



All the cast iron heating pipework is routed at floor level alongside the edge of the pews on both sides of the aisle.

Three different patterns of early cast iron pipe coil heaters (making a total of 3 pairs) can be seen in the Church.

These heaters are all fed by cast iron socket and spigot pipework using caulked and leaded joints.

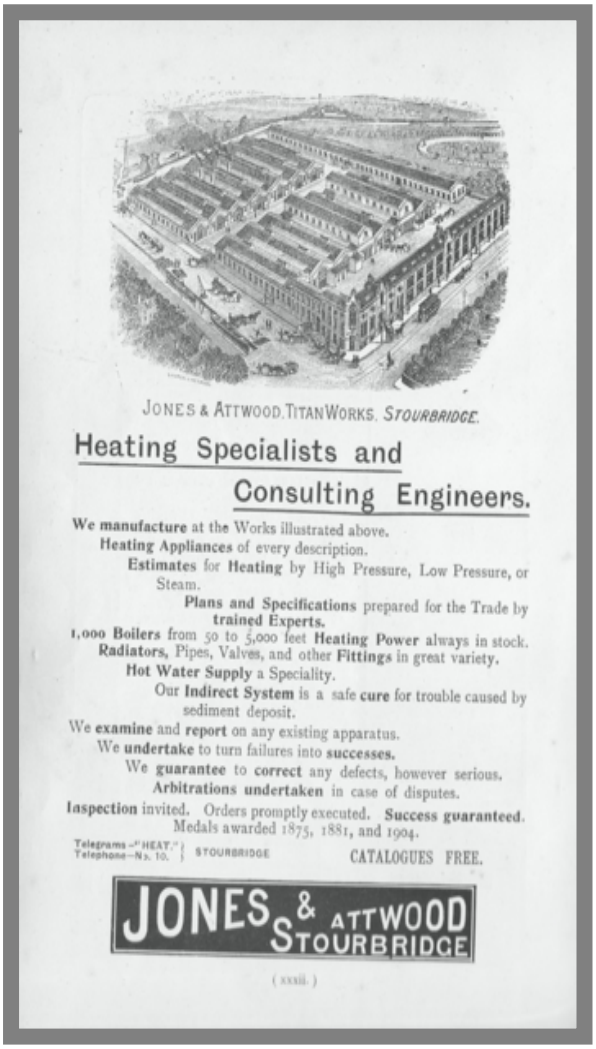
An 8 row cast iron single bank horizontal box ended pipe coil heater with square ends and bottom external socket flow and return pipe connections

Cylindrical vertical tube pattern pipe coil heater with top and bottom header boxes. The flow and return pipe connections are both sited into the underside base plinth of the heater.

A 5 row double bank cast iron horizontal pipe coil heater with square boxed ends and external socket flow and return pipe connections.

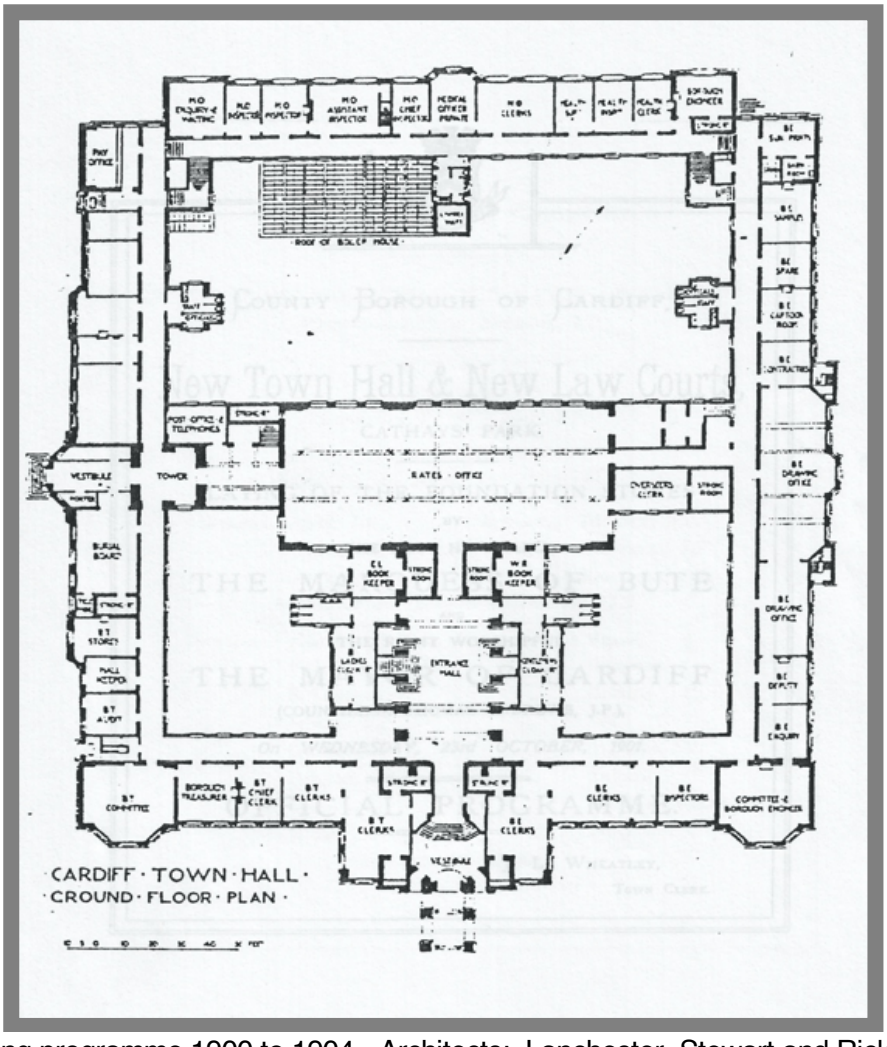
It is unknown to find any heating equipment inscribed with any form of celebratory message, so finding this radiator with an inscription to commemorate the 1887 golden jubilee of Queen Victoria is therefore both extraordinary and wonderful.

The proximity of Elmley Castle to Stourbridge could indicate that the well-known firm of Jones & Attwood of Stourbridge may well have been the manufacturer of this heating equipment.



CITY HALL CARDIFF - WALES

Cardiff City Hall is an imposing building enhancing the Civic Centre area of the Welsh Capital City



Building programme 1900 to 1904 - Architects: Lanchester, Stewart and Rickards.
Main Contractor - Messrs E Turner & Sons Cardiff.

The building is rectangular in shape and predominantly two-storey, with some inner annex areas, larger Assembly, Committee Rooms and Council Chamber.

The main corridor is sited around all four inner elevations of the building. Beneath these corridors are located the Plenum warmed air walkway ducts that provide the airways for the warmed air which heats the 200 rooms of the building.

The Building Engineering Services Contractor for the project was Ashwell & Nesbit of Leicester who manufactured and installed the majority of the H&V equipment.

At the opening ceremony in 0ctober 1906 the official programme lists the heating engineers as James Playfair and David M Nesbit, who were both Directors of Ashwell & Nesbit Ltd.

VENTILATION SYSTEM

Five approx. 5 feet diameter propellor fans manufactured by Blackman & Co provide the heated supply air that warms the building. The supply air for the building is all fresh air.

These fans then discharge the supply air through large walkway sized brickwork ducts which are located under the Ground Floor corridors. From these walkway ducts smaller riser ducts are connected to supply air to the individual rooms at both floor levels of the building. Each riser duct is contained within the fabric of the building structure. All branch duct connections within the basement walkway ducts have a steam heater battery installed to warm the supply air, that is fitted with a flap type volume control damper (VCD). Each VCD has a lockable control position.

Each room in the building has a supply air grating fitted in the wall at high level. A bottom hinged flap damper is fitted to each supply grating which controls the amount of warmed air that can enter the room. The flap damper has a pull cord which allows the room occupant to vary the amount of air entering the room which then provides a course control of the room temperature.

The extracted air from each room is through a similar sized air register fitted at low level which provides the return air path into an extract duct which is contained within the fabric of the building.

This extracted air is then discharged into large brickwork walkway ducts located above the ceiling of the ground floor corridors. In the walkway duct are two extract fans each of double inlet centrifugal pattern. Fan casings are of an unusual design having a 3/4 scroll size sitting on a concrete base. The impellors are fitted with paddle blades. The fan shaft speeds are in the range of 60 to 100 rpm. The fans due to their large size and restricted location appear to have been delivered to the site in manageable sections and then erected in situ, assembling the various sections by simply bolting them together. The fans then discharge the vitiated air into the main brickwork extract tower which houses the chimney and four internal riser ducts that discharge at high level, one to each elevation of the chimney.

Belt drive with propeller fan blades

Note the curvature of the brickwork surround

Supply fan belt drive showing propeller fan blades

View along drive shaft to fan blades

Typical layout of walkway plenum duct

Typical layout of walkway plenum duct

Pairs of finned steam heater batteries

Steam & Condense pipework to heater battery

Three quarter size centrifugal extract fan

Looking into discharge outlet one extract fan

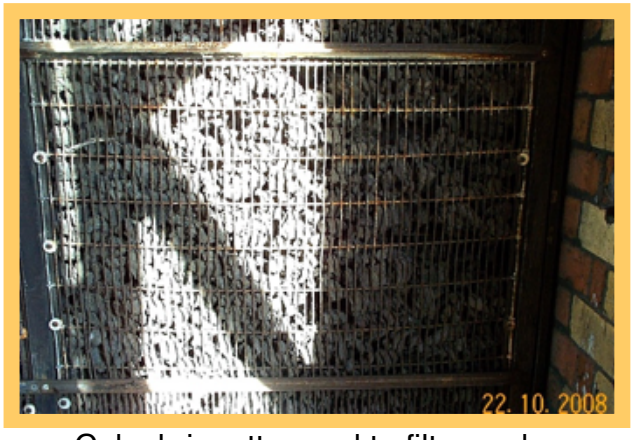
Looking into discharge outlet an extract fan

Main extract tower housing chimney and extract ducts

The Assembly Room and Marble Hall have an independent heating & ventilation system with their own supply and extract fans. The supply air before entering the heater batteries is first passed through a filter screen which uses coke lumps assembled into separate open caged cells. The coke removes the particles of dust and smoke from the fresh air supply. The coke screen was washed and cleaned by cold water from a high-level storage tank which fed a sparge pipe (now removed). This arrangement of filtering the supply air using coke to remove odours was a precursor to what nowadays is known as activated carbon filtration.

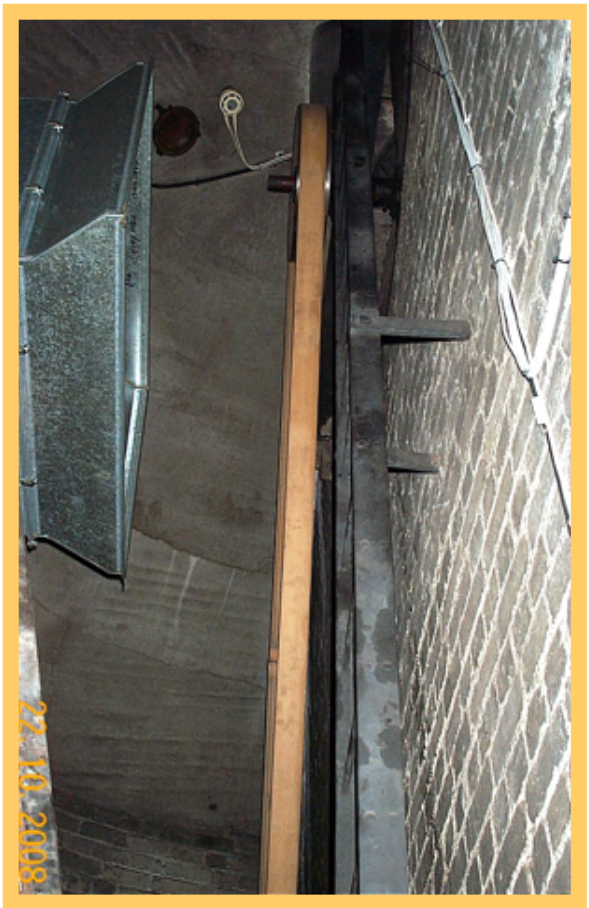
A steam heater battery warms the air before it is supplied to the Assembly Hall through ceiling outlets, and the Marble Hall through high level outlets. Extracted air is removed through low level registers.

Six banks of filter cells filled with coke



Coke briquette used to filter and clean the supply air

Original cold water storage tank supplying washer



Extended belt drive to the supply fan

High level supply air inlet with flap dampers and pull cords

The original arrangement for controlling the high-level flap dampers was effected through a wall mounted key operated winding mechanism, which would vary the amount of warm air entering the room.

This mechanical arrangement was dispensed with as the turn keys were so often misplaced.

Low level extract grating

ATMOSPHERIC STEAM HEATING SYSTEM

The heating system that serves the building is from a design patented by The American Steam Heating Company which developed a steam heating system which operates at sub-atmosphere pressure with vacuum pumps that drew the steam around the pipework, and then returned the condensate back to a hotwell for reuse in the steam boilers. Ashwell & Nesbit reached an agreement with the American company and installed the system named the "Nuconomiser" under licence in the UK. This installation is given the number 18, so it would be interesting to know where the previous 17 installations were located. D M Nesbit was later granted a Patent for a modification to this type of atmospheric system that became known as the "Nuvacuumette".

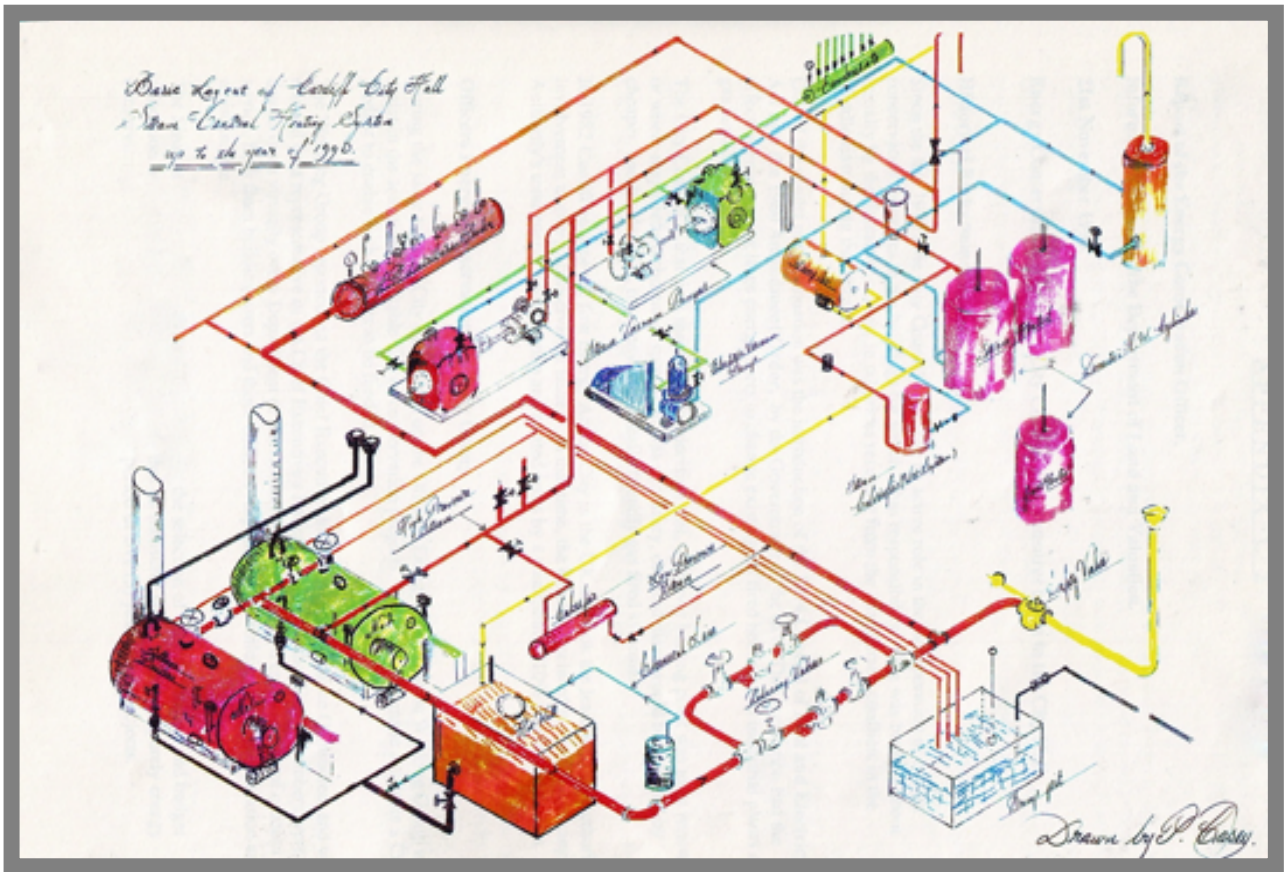
Two GWB Powermaster steam boilers were installed in 1968 replacing the original two solid fuel boilers. They operate at a working pressure which varies between 40 and 55psi according to the varying loads imposed by the building. Safety valves are set at 62psi.

The main pressure reducing valve with a downstream pressure set at 1.2 - 1.5psi. supplies the sub atmospheric steam distribution pipe system. The steam pipework feeds the fresh air heater batteries. The vacuum pump operates at 16-17psi to provide the necessary pressure differential to induce the steam around the pipework and return the condensate to the hotwell.

Steam fed natural convectors are installed, to provide heating to the transient areas, Corridors, Foyer and Entrance Hall.

Both boilers and vacuum pumps have a duty/standby facility operating a weekly changeover.

An electric vacuum pump is also installed to provide emergency back-up.



Isometric layout of the plant and pipework in the Boiler House

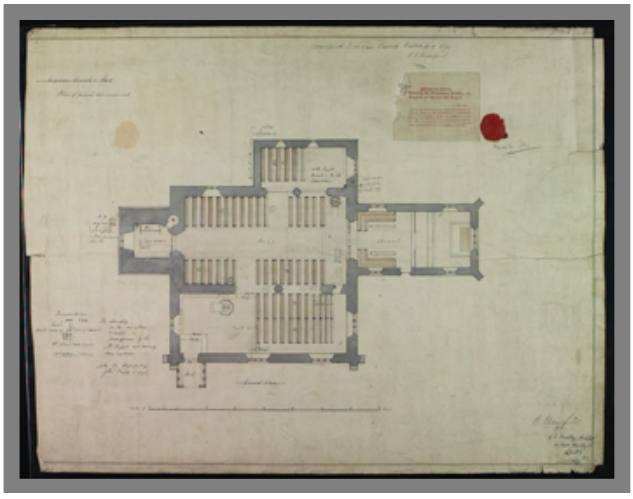
Left side Vacuum Pump.

Right side Vacuum Pump

This nameplate was most likely removed from one of the original solid fuel boilers that were replaced in 1968

ST JAMES THE APOSTLE WIGMORE HEREFORDSHIRE

St James the Apostle is a Grade 1 Listed church that dates from the 11th Century. The church is sited close to the ruins of Wigmore Castle and is located within Mortimore Country.



Floor plan of the 1864 restoration by architect G F Bodley

The heating system is based upon the Hypocaust method used by the Romans when they warmed their Villas and Bathhouses. The Roman Hypocaust had a furnace which circulated the hot flue gases through floor voids and thence through ducts or chimneys built into the walls to rise up and exit to atmosphere. The hot flue gases heated the solid floors and walls which then radiated their heat into the space to be heated.

The heating system in St James uses a similar method but has 'hot-fire pits' built in the aisles that house the furnaces. Underfloor flue ducts from the fire pits are used to remove and transfer the hot flue gases before dispersing them up through a tall chimney located within the Tower. Two fire pit furnaces in the floor constructed from brickwork are built close to the south wall with their flue exit ducts traversing the floors conveying the hot flue gases to the chimney.

A report written by architect Basil Stallybrass gives his assessment on the state of the existing heating that says "*stoves in the middle of the floor connected by a flue beneath it to a chimney in the Tower with a pilot stove at the bottom of the chimney*"

The report implies that there were more than the two hot-fire pits built when the Hypocaust system was originally installed than remain today, assuming this occurred at the time of the Victorian restoration in 1864.

The fire pits have cast iron floor cover plates inlaid and set into the floor surface on top of the fire pit. The floorplate has a small removable centre section with an opening that enables it to be lifted out. Both plates have the following written inscription

Wm Hodson - 8 Alveston Place - Leamington - Wark - Mitchell's Principle - Church Heating.

Mitchell is assumed to be the name of the person who devised this Principle that was used as a hypocaust method for warming a Church.

Cast iron floorplate with inscription and removable centre section

Floor plate removed looking into brickwork hot-fire pit

Looking down into the brickwork fire pit

Section of the underfloor flue duct enclosed in brickwork

View across South Aisle showing marker tapes over floor ducts

Floor duct viewed from South

Twin floor ducts viewed from West

Twin floor ducts viewed from North

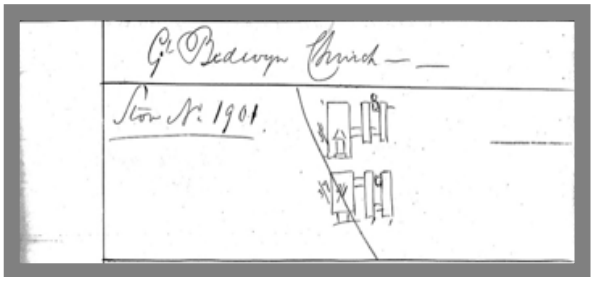
ST MARY'S GREAT BEDWYN WILTSHIRE

The Church's origins date back to the 11th century and later underwent an elaborate restoration in the Victorian period during the 1860's.

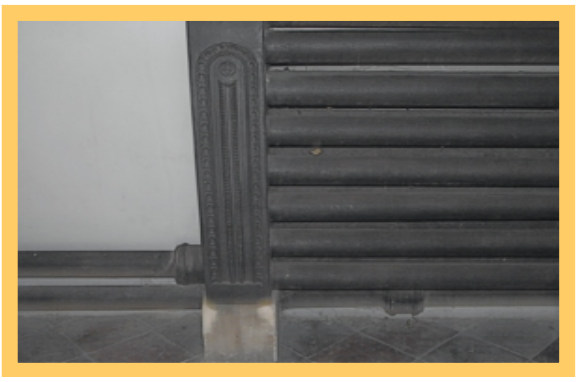
Cast iron floor grating for the warm air heating system

The church has had a long history of different heating systems installed during the 1800 and 1900's. Evidence remains of the original warm air heating system using a furnace stove located in a basement room supplying warmed air to the church through several floor gratings sited in the aisles.

Researching the Haden warm air stoves order books held in the Haden Archive at the Wiltshire History Centre showed that installed warm air stove was No.1901 ordered on the 9th January 1860. The entry in the order book is shown below.



Later wet heating systems in the church appear to have been installed in three stages. The first two stages still remain as they were when originally installed during the late Victorian period and Edwardian period. The Victorian heating system using cast iron socket and spigot pipework feeding box-ended pipe coil heaters was most likely installed in the 1880's.



All the pipe coil heaters have decorative end header boxes.

CIBSE HERITAGE GROUP

(l-r) John Barnes, Ian Stewart, Stephen Loyd, Mike Barber, Frank Ferris
(seated) Brian Roberts & Paul Yunnie in a Committee Room at CIBSE HQ Balham London

CREDITS

This tenth book in the Building Engineering Services Heritage Revisited Series follows its predecessor Part 2 and is again a collaborative effort by the members of the CIBSE Heritage Group. Thanks are given to members who have contributed to the store of books, documents, photographs and illustrations in the Heritage Group Collection. A special thanks goes to our friends at Historic England and National Trust for their considerable assistance.

For more information about any of the buildings in this booklet visit the Heritage Group Website at <www.hevac-heritage.org>