Souvenir Guide to

CAMBRIDGE MUSEUM OF TECHNOLOGY

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CAMBRIDGE MUSEUM OF TECHNOLOGY

INTRODUCTION

Sewage : The Problem

Until the end of the Victorian era, Cambridge had a very simple sewage disposal system : it was called the River Cam. Numerous small sewers emptied directly into the river along its whole length through the town, while some properties had cess pits that did not work efficiently because of the high water table. This had highly offensive results and was long recognised as a major health hazard. There is a story, perhaps apocryphal, that on a visit to Cambridge, Queen Victoria was dining with the Master of Trinity and asked him, “What are those pieces of paper floating in the river ?” His quick, and extremely tactful response - “Those, Ma'am, are notices prohibiting bathing”.

Over the years there were numerous proposals for dealing with the problem and each was discussed at considerable length. Inevitably someone had very strong objections to any particular proposal so, it was shelved and things were left as they were until discussions started on a new idea.

The Solution

Finally, in the early 1890s, a disposal system was agreed : a sewage farm would be built on land at Milton. Main sewers were built intercepting most of the existing sewers and running to a deep well at the lowest point in Cambridge, old clay pits on Riverside. Here a pumping station was built to raise the sewage from the well and push it along a 24 inch main sewer two miles (4km) to the Milton sewage farm. The pumping station is now the Cambridge Museum of Technology.

Milton was a genuine farm, where sewage was run out over a group of the fields for some time, then the land was ploughed and crops grown on it while the sewage was pumped over the next group of fields. Thus the disposal of the sewage helped fertilise the land for profitable crop production. The initial farm was of 65 acres (26.5ha), but was enlarged to 177 acres (71.7ha) in 1923. A problem with this type of sewage disposal is that the land eventually becomes sour and crop yields fall, so in 1937 the farm

was converted into a sewage treatment works. This was enlarged and modernised in the period from 1973 to 1978. Strictly, when first acquired the sewage farm was in Chesterton but boundary changes in 1912 transferred it to Milton. Further changes in 1935 brought it within the Cambridge boundary but it is still referred to as Milton Sewage Works.

The pumping station was equipped with two steam-powered pumping engines supplied by Hathorn Davey & Co. of Leeds. In 1894 these were scarcely new technology, but they were a tried and trusted method readily understood by those involved in decision making. Importantly, they were relatively cheap to install, could easily and reliably cope with the task demanded of them and were easy and cheap to run and maintain. In spite of the growth of Cambridge, they were always able to cope with the normal sewage flow which increased from two million gallons a day (9,920,000 litres) in 1894 to five million gallons a day (25,300,000 litres) in 1968.

However, there was a problem created by rainwater run-off from roofs, roads, etc., which was also directed into the sewers. Heavy rain meant a so-called storm surge of water pouring down the sewers with which the pumps were unable to cope. To deal with this, more pumping capacity was added, not further steam engines but, as technology had developed, equipment that had greater pumping capacity at lower costs, gas fuelled internal combustion engines in 1909 and an electric pump in 1937. In addition to the extra pumping capacity, large storm water holding tanks were built to which the output of the pumps could be diverted. Here the storm water could be held until the main pumps could cope with it.

In the1960s modernisation was again needed, the outcome of which was a new separate pumping station. Built next to CMT, the Riverside Pumping Station was all electric, each pump was driven by an electric motor and all the control was electronic. The Riverside Station was demolished some 30 years later and the site is now housing. The sewage now flows in a big, four metre diameter, long tunnel all the way to Milton.

The Museum Arrives

The old pumping station had been closed and there were plans to demolish it and redevelop the site. This was delayed by the action of a group of Cambridge residents and members of the University who realised the unique importance of the engines. It was also realised that the site provided an opportunity to create a Museum of Technology for Cambridge, illustrating the technological developments of the 19th and early 20th centuries, the reciprocating steam engine, the internal combustion engine and the early days of electric power. The Museum would also acquire exhibits to illustrate the industrial history and technological innovations of the area.

The importance of the original steam engines resulted in the site being scheduled as a historic monument. A charitable trust was set up to acquire the site from the Council and develop the museum, the situation today. Rehabilitation and renovation of the buildings progress steadily, a substantial proportion of the original equipment has been restored to working order and other items illustrating the technological developments of the 19th and 20th centuries have been introduced.

Progress is inevitably slower than anyone would like. The museum is organised and run almost entirely by volunteers working in their spare time. Grants are obtained from English Heritage and Cambridge City Council for some specific repairs to the buildings and there is an annual grant from the City Council and support from some other organisations. However the bulk of the museum's income is from admission charges and shop sales and the total money available is often inadequate. Volunteers sometimes have to finance restoration work out of their own pockets and appeals, borrowing and scrounging are the order of the day. Nevertheless, progress is made, and the pumping station has been, and will continue to be, preserved as a working steam museum.

What of the new ? Although the new 1968 electric pumping station could deal with nearly three times as much sewage as the old one, the mains to Milton were still too small to cope with

storm surges and holding tanks were still necessary. In very heavy rainfall these filled and the overflow system still emptied, with raw sewage, into the River Cam. It was also relatively expensive to run and maintain so a decision was made to replace it. Completed in 1997, a new deep, large diameter sewer was constructed through Cambridge to Milton, with pumping being carried out at the Milton works. The "new" pumping station had lasted 25 years compared with the 74-year working life of the old station.

The Buildings

LHS	Centre	RHS
1909 building Gas engine room Rounded windows top Similar style to 1894 Flat roof.	1937 building Electric pump Very square looking No rounded features Flat roof.	The 1894 building Steam engine house Rounded windows top Decorative brickwork Pitched roof & lantern

The part built in 1894 is in the lavish style typical for public buildings of the period. It is of local white brick with ornate moulded red brick decoration: the magnificent decorated chimney is outstanding. Inside, the tiled walls and pitch pine roof joists and lining are equally fine. Remember, all this was for a

building that burnt the town's rubbish and pumped its sewage. It is a typical example of the civic pride of the period. Accounts show the total cost of the building and equipment to have been £10,177.

Later additions show either a decline in civic pride or in architectural standards – or an increasing cost consciousness. The Gas Engine Room of 1909 makes some effort to match the original building but doesn't quite make it, while with the Electric Room of 1937, the attempt to match the existing buildings is a token one with the use of red and white bricks. The Second World War screening of the Charging Floor and Top Bay of timber and corrugated iron is typically utilitarian, while the 1950s extension for the electrical de-oiling plant, now the Museum tickets and sales shop, might also be described as redolent of its period.

Working Conditions

The working conditions in the pumping station have been fully described in the booklet *Cheddars Lane: Running and maintaining a steam pumping station* by W L Read & K A Knell which is available in the Museum Shop.

Needless to say, conditions were unpleasant and what was normal even in 1968 would be unacceptable today. Sparkling cleanliness was required in the engine room while the boiler room, or stoke hole, provided conditions of filth and squalor. Work in the pumping station was both hard and arduous.

In the later years of the station there was a shift system of three shifts, 6am till 2pm, 2pm till 10pm and 10pm till 6am. Each shift was worked by an engine driver, a stoker and a cleaner/driver's assistant. The day staff consisted of the engineer manager, his assistant, a sub station maintenance fitter, two yard men and a destructor labourer. Originally there were nine men working the refuse destructors but this number was reduced in 1942 when the disposal of household rubbish ceased. Day staff worked 7am till 5pm Mondays to Fridays, with a breakfast break from 8 till 8.30am and a lunch break from 1pm till 2pm, and 8am till 12 noon on Saturdays.

Meals were not provided, men bringing their food with them and heating it on the steam chest of an engine, while toast was made on the boiler shovel (today's volunteers still find these culinary techniques useful). Until the late 1940s there were neither showers nor hand basins, no washing facilities of any kind, no locker room and no mess room. The original toilet facilities were in the basement consisting of a hole in the floor over the main sewage well. With eight hours worked over sewage and refuse, only carbolic liquid as a disinfectant and working conditions that would drive today's Health and Safety Inspectors frantic, it is remarkable that there is no record of any serious disease and few serious accidents.

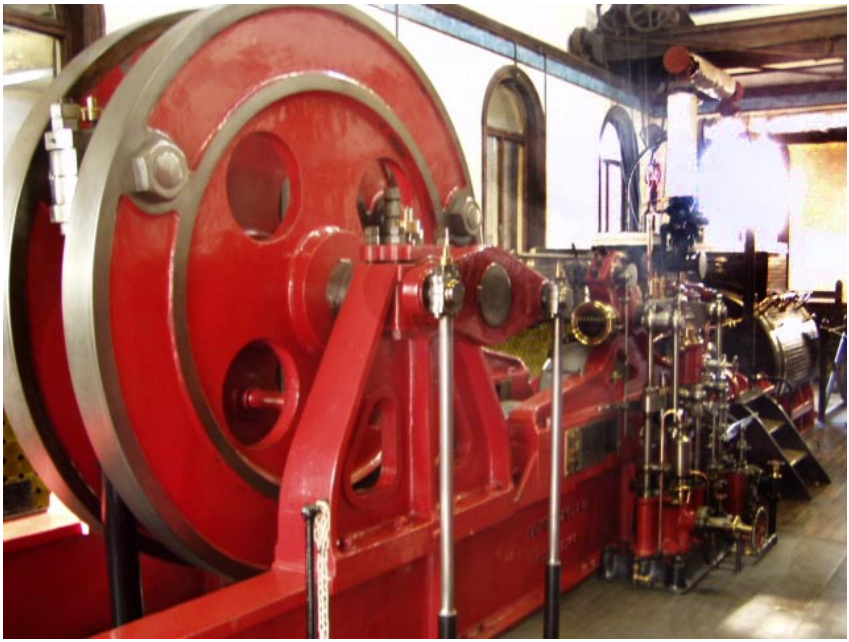
The Environment. What's New ?

Energy conservation, recycling and the environment are all modern concerns, with new ideas introduced to address these concerns, but how new is any of it ?

The very purpose of the pumping station and sewage works was to improve the condition of the River Cam and restore a damaged environment. The waste product, sewage, was "recycled" as fertiliser for crop production. Fossil fuels were not used : the town's rubbish of paper, wood, leather, vegetable waste, etc., was the equivalent of the modern idea of biomass, recycling recently absorbed carbon dioxide through the atmosphere rather than increasing carbon dioxide levels with fossil carbon. Tin cans were recycled as scrap and even the clinker from the furnaces was used for road making.

Cambridge was not unique : all over the country water or sewage pumping stations and even power stations were fired on rubbish. Yet none of this was done with any idea of conservation or the environment, it was seen as just plain common sense. What went wrong ?

Main Engine Room



The two 1894 engines dominate the Main Engine room, being 80hp (60kw) Hathorn Davey engines fitted with the two speed version of the Davey differential valve gear. This type of engine was once quite common and used for a variety of pumping tasks, keeping mines clear of water, pumping drinking water etc. Now the engines here are the only ones on public display that can still be run by steam. The two engines were not run at the same time, usually they were worked one week on and one week off with one engine in use and the other being serviced or repaired.

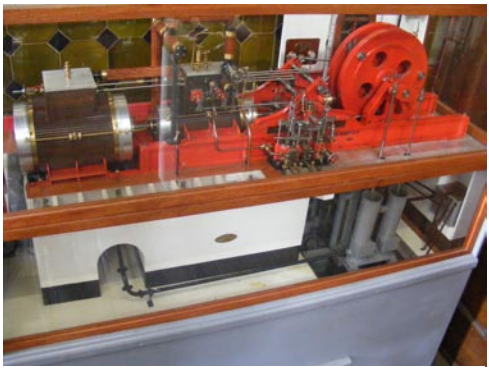
The large, 8ft (2.44m) diameter flywheels do not rotate and so are not really flywheels at all as they are disc shaped rocking beams which act as a 90º crank converting the horizontal motion of the engine into a vertical movement of the pump rods. These work in such a way that the force on the pump is the same throughout the stroke, instead of increasing and decreasing with the engine's motion. The pumps are located in the basement below the engines, two to each engine. They are simple bucket pumps which at each stroke lifted 160 gallons (722 litres) of

sewage 45 ft (15.25 metres) from the well and sent it two miles (4km) along the 24 in (0.6m) diameter main to Milton.

Were there giants on the earth in those days? Note the size of the nuts securing the pump rod journals to the rocking disc. The spanners to fit them weigh 46 lbs (21 kilos).

The engine itself is a tandem compound with high and low pressure cylinders in line. Steam at 80 lbs/square inch is fed, via the slide valve, to the high pressure cylinder which is 22 in (0.56 m) in diameter, as it is exhausted from this cylinder, at a pressure of 13 lbs/square inch (1 bar), it passes to the low pressure cylinder of 44 in (1.12 m) diameter, where further energy is extracted from it. From the low pressure cylinder the steam exhausts to a condenser in the basement where it is converted back into water which runs into the boiler feed well. This creates a vacuum of 20 in (50 mbar) on the exhaust side of the low pressure cylinder which improves the efficiency of the engine. The stroke of the engine is 4 ft (1.22 m). The coolant used in the condensers was the sewage being pumped to Milton. Today, since there is no sewage in the system, the pump well contains clean water. The pipe work is now such that the condenser uses water pumped from the well and then retuned to the well.

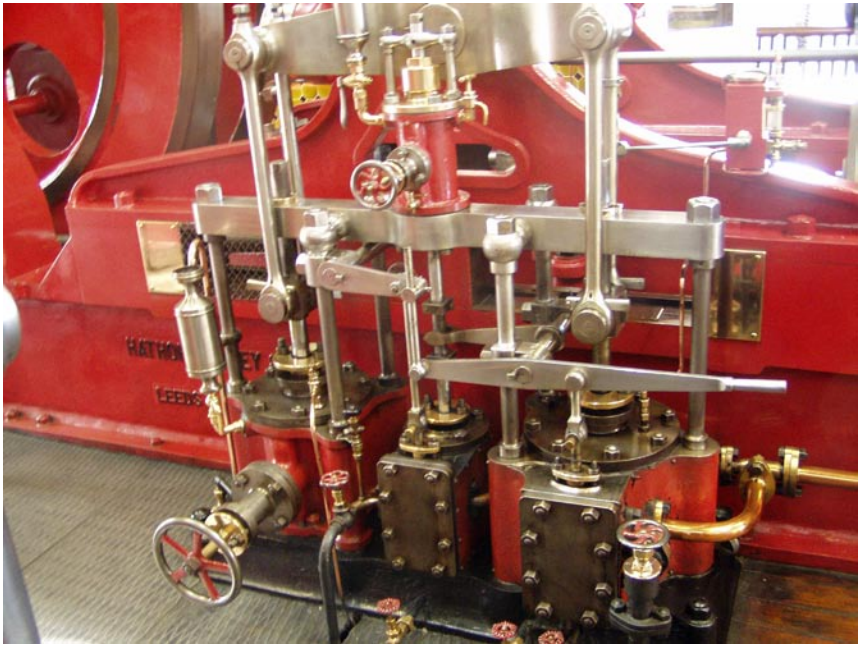
The model of the main engine shows well how the pump and engine are connected. In reality, it is difficult to see how the pump works because a lot of it is unseen in the well.
This model was made by Don Unwin, a founder member of the Museum who was an instrument maker with Cambridge Scientific Instrument Company.



In the model the steam engine is coloured red and the pump is coloured grey

Engine Control

The mechanism situated halfway along the engines, on the side towards the centre of the room, is the Davey differential valve gear, an ingenious system which involves negative feedback and two variable delays. It was developed to overcome problems of variations in speed and load which could set up damaging stresses. If a pump rod broke, the resulting loss in load could allow the engine to run away and be damaged or wrecked.



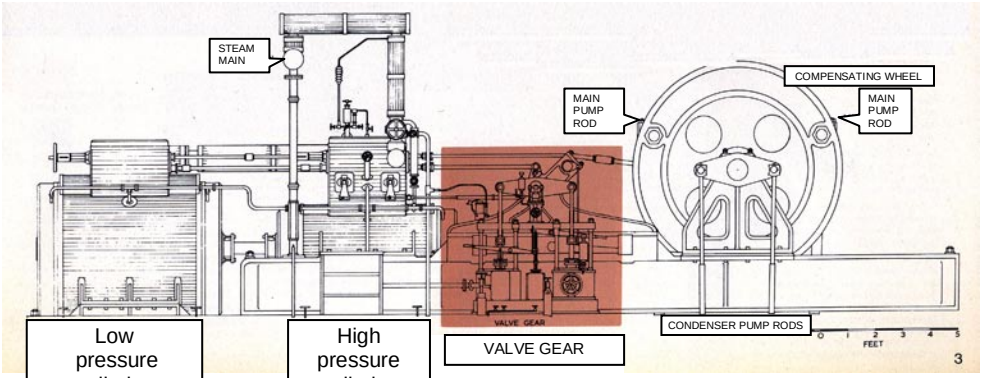
Davey differential valve gear

The gear is complex and contains two small steam engines. The first, auxiliary cylinder, operates against a cataract, a piston in a cylinder full of water. The rate of flow of the water past the piston can be controlled by the engine driver and this controls the speed at which the small engine works. This small engine operates the valves of the main engine which is forced to follow it, thus it controls the speed of the pumping strokes. The other small engine also operates against a cataract and simply introduces a pause between each stroke of the main engine, to control the period of stroke. The engine could operate at up to

16 strokes a minute, but in practice 14 was the fastest at which the engine was run.

These small engines work in conjunction with a slide valve driven by the motion of the main flywheel. As the main engine is forced to follow the small ones it cannot run away. The slide valve is automatically adjusted to the cut off point of steam admission depending on the load.

What has been described is the low speed setting of the mechanism, but there is an alternative high speed setting in which the pause cylinder is disconnected and the auxiliary cylinder speed controlled from the main drive. This was tried once with the south engine : the necessary repairs to the flywheel support frame and the cracks in the wall where the engine tried to tear itself out of the building can still be seen. The experiment was not repeated . . .



Low pressure cylinder

High pressure cylinder

VALVE GEAR

Drawing by M L W SALZER FEB 1973

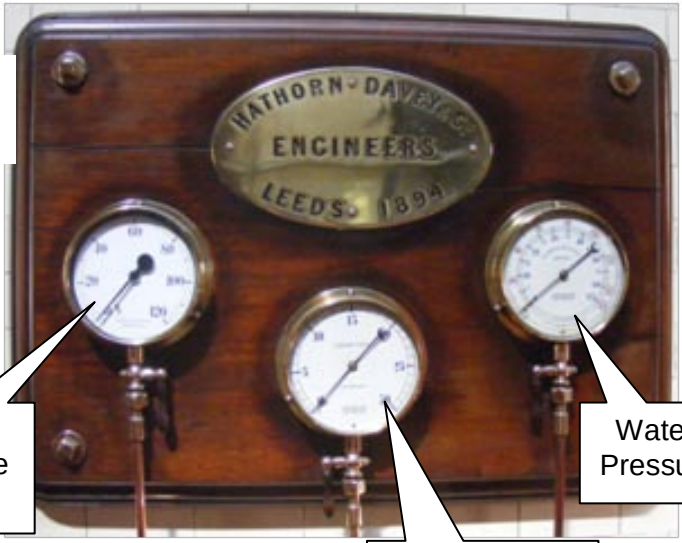
Engineering Drawing of Main Engine
HATHORN DAVEY 1895 TANDEM COMPOUND STEAM ENGINE

Wall Gauges

Depth of sewage indicator

The gauges on the wall provided the engine driver with all the information he needed to run the engine at the right speed to keep the sewage in the well and not overflow.
The height indicator is driven by a float on top of the water in the well.
Of the three circular shinny brass gauges mounted on a board with the polished brass name plate, the left one is the gauge showing the boiler steam pressure, the middle one is the vacuum gauge showing how well the condenser is working, on the right is the gauge showing water pressure.

Gauge Board



Steam pressure in boiler

Water Pressure

Vacuum in the condenser

Water Depth Recorder

If the well did overflow, who would be to blame for the smelly mess? The instrument that recorded well water depth and steam pressure enabled the engineer manager to decide responsibility between the engine driver and stoker if the sewage level rose too high and flooded the basement.

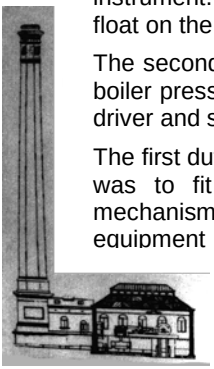
Water Depth and
Steam Pressure recorder

WATER DEPTH RECORDER

Manufactured by Glenfield Coy Limited

Kilmarnock c1895

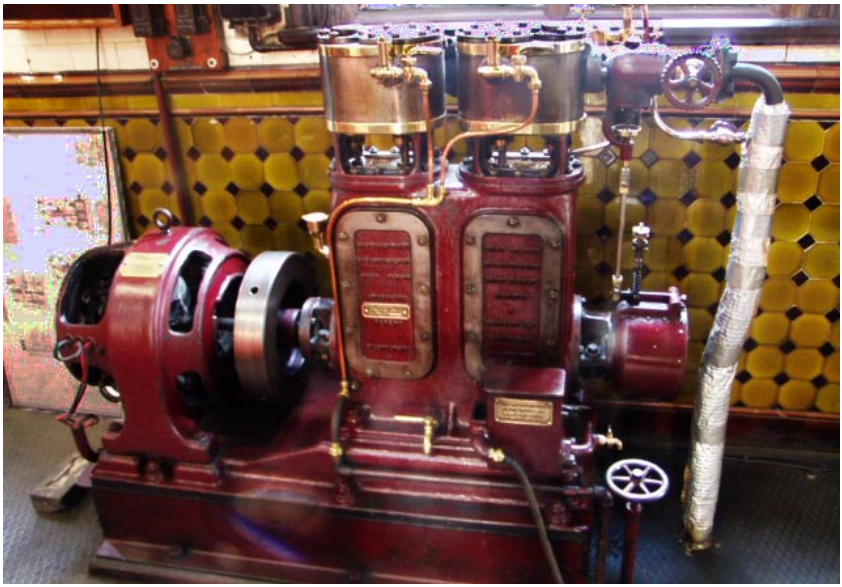
The depth of water in the pump well below the engine room was continuously recorded on the paper chart by means of the pen which was moved up and down by a cord wound round the wheel on the lower right of the instrument. This cord (now removed) was attached to a float on the surface of the water in the well below.



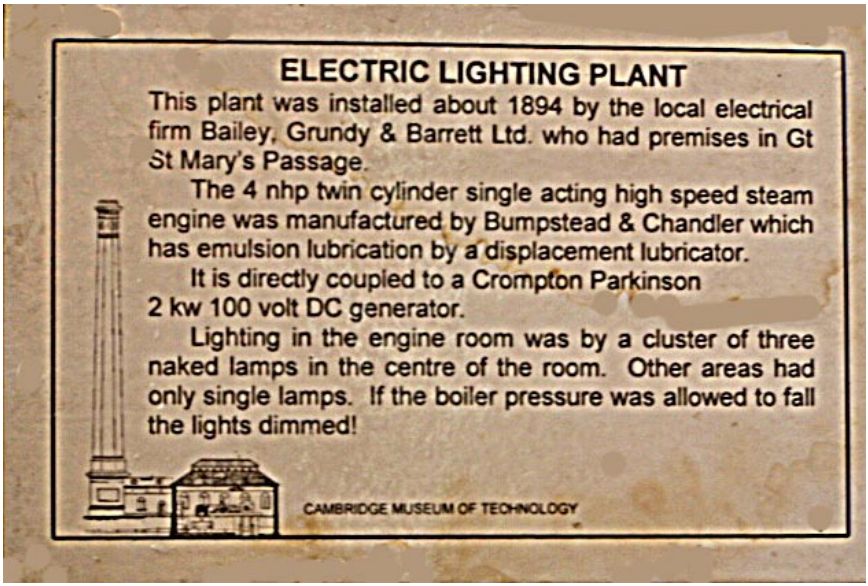
The second pen, which is a later addition, records the boiler pressure. It was fitted to avoid conflicts between driver and stoker.

The first duty of the oncoming shift on Monday morning was to fit a new chart and wind the clockwork mechanism. Glenfield made a wide range of equipment for public utilities ranging from street water

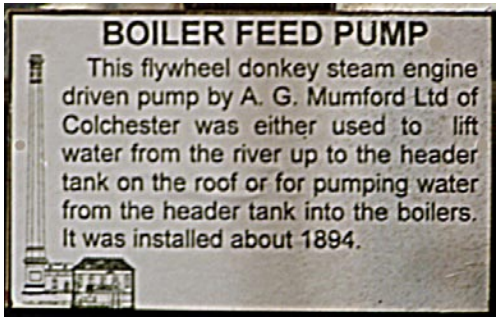
Electricity Generator Set



By the entrance doors of the main engine room is a generator set consisting of a Bumpstead and Chandler 4hp (3kw) engine driving a Crompton and Parkinson 2kw generator supplying 100 volts DC. This provided the pumping station with its own electric light supply. In 1895 electric lighting was very new and rare.

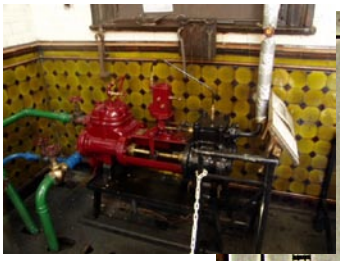


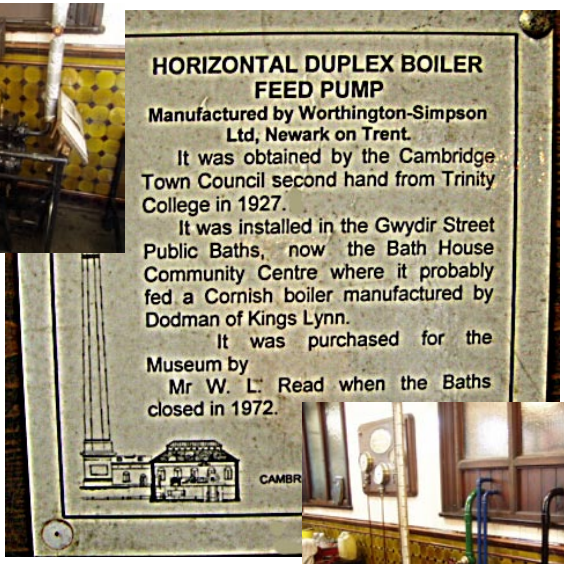
The small engines



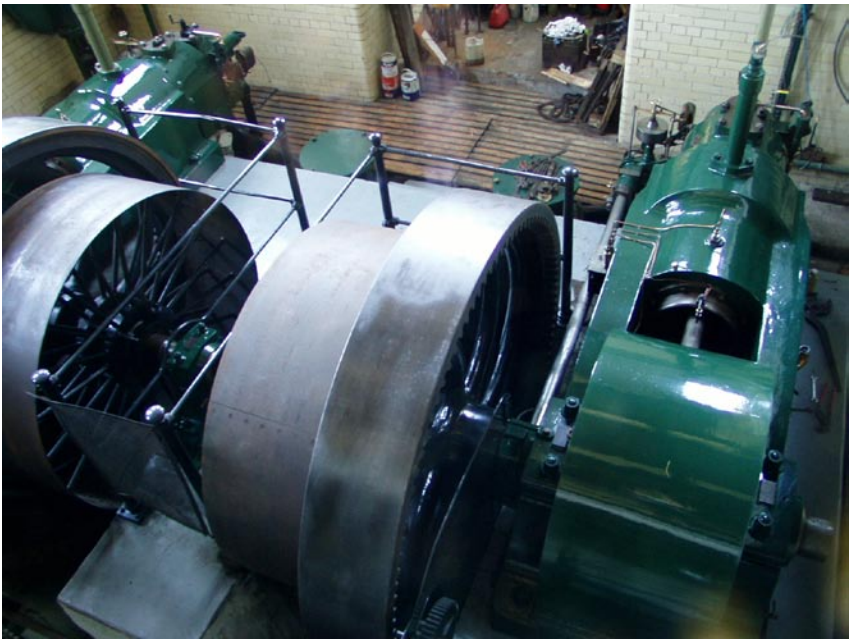
The main engine room also houses a Mumford flywheel donkey steam pump which feeds water to the boiler.

There are two Worthington Simpson steam pumps which originally circulated cooling water to the gas engine jackets. These pumps were obtained second hand from a local brickworks when our gas engines were installed, see next section





Gas Engine Room



The gas engines were installed in 1909 to pump the increasing levels of storm water surges created by extensive house building in the town. They are 94 hp (70 kw) National Gas Engines and drove the pumps through a flat belt drive, now removed for safety reasons. The old belts are on the floor of the viewing platform.
Original Rees Rototurbo centrifugal pumps were installed. In 1935 these pumps were replaced by Gwynnes centrifugal pumps. Each pump could pump 184,000 gallons (836,500 litres) per hour. Sewage could be pumped either along the mains to Milton or into three large storm water holding tanks located adjacent / downstream of the pumping station.

Gas engines were installed as they could be started up rapidly, well within the half hour it took storm water to reach the pumping station from the centre of Cambridge. It would have taken too long to start up the second steam engine (several hours), even if the maintenance schedule allowed it. The engines are 4-stroke internal combustion engines, like a single cylinder from a car engine, or a motor bike engine.

An engine was started with the belt drive running free. The pump has two pulleys on the same shaft, one pulley drives the pump, the other is free to rotate on the shaft. The engine would be started with the belt on the free pulley. Before starting the engine, air is purged from the combustion chamber by burning the gases at a vent until the flame turns from yellow to blue. Then about 40 units (pump strokes) of air are pumped into the engine manually followed by 30 units of gas. This produces a highly explosive mixture under pressure in the combustion chamber. The magnetos are plugged in and one of them is flicked to produce a small spark in the combustion chamber to ignite the mixture and the engine should begin to move otherwise the whole procedure starts again. When the engine is running smoothly it is adjusted to admit twice the amount of gas and air, increasing the power of the explosion and the speed of the engine.

While this was happening the pumps were being primed by running steam into them and allowing it to condense. When the engine was running at the right speed the order was given to "pull the belt over" to connect the pump to the engine drive.

Water Mains

Also in the gas engine room is a display of water main fittings donated by the Cambridge University & Town Water Company (now Cambridge Water Company).

Fleam Dyke Sight Glass

Mounted on the end of the Water Company display case is a sight glass from one of the Lancashire boilers at the former Fleam Dyke Pumping Station which was located near Fulbourn.

The Fleam Dyke Station was similar to this station in that it had two steam engines driving pumps. These pumps extracted fresh water from the ground and pumped it into the water mains. The station started work in 1920 and was closed in 1976. In 1983 the engines were scarped and the building demolished.

The boiler man keeps a close eye on the sight glass on the front of his boiler. The sight glass tells him how much water there is in the boiler. If he were to let the boiler run dry then major damage would be done to the boiler.

Early Water Main

Nearby there are exhibits from earlier Cambridge water supplies including a section of lead pipe with stop and drain cocks from the Trinity Conduit, and a plug cock of c1840 from Hobson's Conduit, a fresh water supply to the town provided by Thomas Hobson and his fellow businessmen in the early seventeenth century.

The Electric Room

This room was built to house a 114hp (85kw) Crompton Parkinson electric motor driving an 18inch diameter (0.46m) Gwynnes centrifugal pump in the basement below. The basement is not accessible to Visitors. The pump was installed in 1937 to cope with storm water surges caused by increased run off from new roads and housing in the area. The electric motor and its control gear are at the Riverside end of the building. This could pump 406,000 gallons per hour (184,5674 litres) into the storm tanks; it was never used to pump sewage to Milton. Provision was made for a second pump, but this was never installed.

The electric pump represented a newer technology than the earlier engines on the site. It is a little surprising, though, that this is about the earliest date that such a pump could have been installed here. Cambridge had an electricity supply from 1894 when the power station opened in Thompson's Lane, but initially this was for lighting only. Though supplies for power were available in the centre of the town in the1880s, it was only in the 1930s that a supply capable of powering this pump became available in the Pumping Station locality.

Domestic Electrical Equipment

The room now houses a display of domestic electrical equipment ranging from early light bulbs, plugs, sockets & fuses to radios of the 1920s to 1950s. There are also various electrical measuring devices and scientific instruments on display. Many of these were manufactured by local firms such as the Cambridge Instrument Company, founded in 1881, and W G Pye, founded in 1896.

Pye Radio

Looking out of the window and across the river Cam can be seen the wavy line roof building. This is the last remaining building of the Pye company. Founded in 1896, it became a major producer of radio and television. In the 1920s the company developed radio from the crystal set to the "rising sun" set for the domestic market. Then after WWII television was developed – a black and white picture screen with 405 lines. Pye was a big employer in Cambridge.

The renowned Pye wireless radio receiver whose "rising sun" fretwork cut in the polished wood cabinet allowed sound to pass through the gauze obscuring the loudspeaker behind.

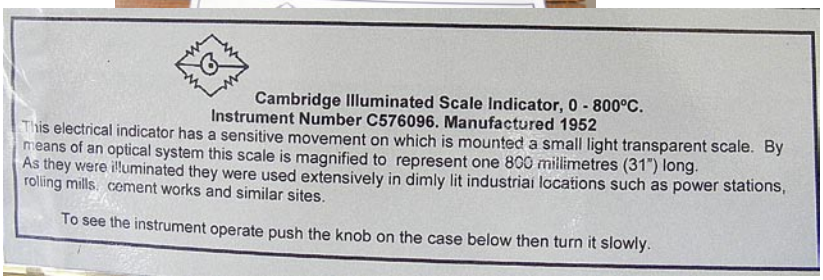
Cambridge Instrument Company

Various electrical measuring devices and scientific instruments are also on display. Many of these were manufactured by the local firm, Cambridge Instrument Company, formerly a big employer in Cambridge.

Cambridge Indicator

Push the button and see the spot move.

The Cambridge Indicator was manufactured by the Cambridge Instrument Company, hence the name on the front. This instrument works by shining a spot of light on to the window which has the scale on it. As the quantity being measured varies so the spot moves in the window.



Cambridge Illuminated Scale Indicator, 0 - 800°C.
Instrument Number C576096. Manufactured 1952

This electrical indicator has a sensitive movement on which is mounted a small light transparent scale. By means of an optical system this scale is magnified to represent one 800 millimetres (31") long. As they were illuminated they were used extensively in dimly lit industrial locations such as power stations, rolling mills, cement works and similar sites.

To see the instrument operate push the knob on the case below then turn it slowly.

The increasing product ranges and output growth of both the Cambridge Instrument Company and W. G. Pye were early examples of what came later to be called the “Cambridge Phenomenon”.

Time Clock

In the passage at the end of the Main Engine Room are two Clocking In clocks.

A device used to record the times at which workers started and finished their shifts. When the pointer is moved to a particular works number and pushed in, it stamps the time (as start or end of a shift) against the same number on a paper roll inside the clock.
This time-clock was purchased second hand by London Instrument Co, Ltd. (now Cantabrian Ltd.) from Fravenders, a large general shop on the corner of Bene't Street, for 10/- (50p) in 1930. London Instrument Co. were then at 51A Bridge Street; they later moved to Newnham Mill and are now at Rosemary Lane.

Daytime Recorder Clock

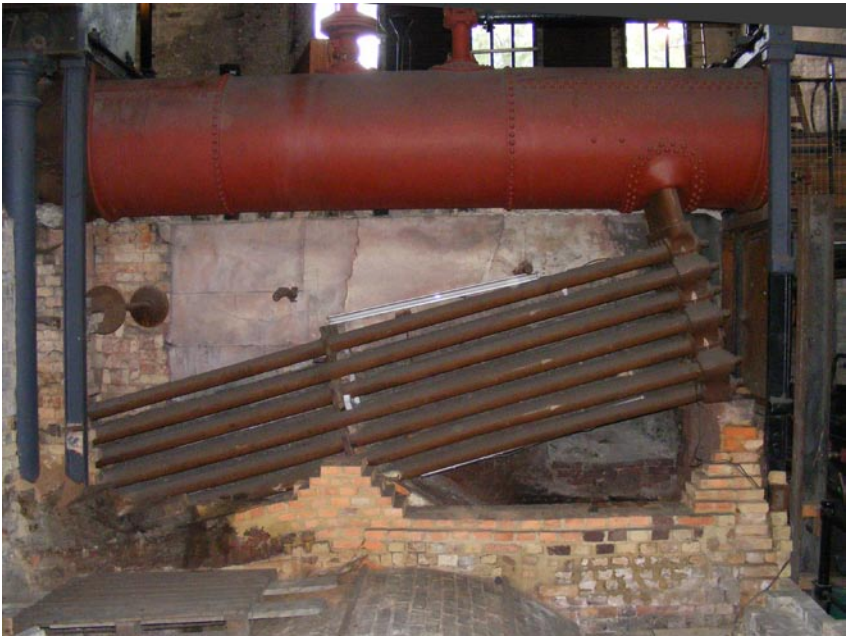
This time clock was originally used at the ironmongers, Mackays, in East Road.

In the shop you can buy a card for this machine

The Boiler Room

When the pumping station was first built, steam to drive the engines was provided by three Babcock and Wilcox water tube boilers. These could be fired in the normal way, with coal or coke through the fire door in the front. Normally however, they were fuelled with the city's refuse in furnaces or “destructor cells”, two to each boiler. The rubbish was shovelled into the furnaces from the floor above, having been dumped in the top bay by the horse drawn refuse carts. In 1904 about 32 tons/day (35,000 kg) of rubbish was being burnt in the furnaces.

Boiler No.3 has been removed, as has one of the destructor cells of Boiler No.2 so that the structure of this type of boiler can be seen. The flue from the furnaces to the chimney ran underneath the boilers and is the “tunnel” which can be seen between Boiler No.2 and the wood pile. It had to be cleared of soot and ash once a year, dug out by hand while the boilers were still in use!



Boiler No.4

Boiler No.4, also a Babcock & Wilcox water tube boiler, was installed in 1923 and burnt coke. Initially it was used at weekends, when there was no rubbish collected to burn, but as the fuel value of the rubbish declined it was used for an increasing part of the time. From 1942 it was used as the main source of steam and household rubbish was no longer burnt. It consumed about 20-21 barrow loads, each of 1 cwt. (76kg), of coke per day. The destructor cells were used for burning trade rubbish until the pumping station closed in 1968.

Although coke was readily available from the Gas Works next door, most of the coke used to fire the boiler was obtained from a London firm & brought to Cambridge by rail. This source was marginally cheaper than the Cambridge supply.

Boiler No.4 is the one used today when the engines are run, but the fuel used may be coke, wood or coal. It is run at a pressure of 60-80 lbs/ square inch (about 4-5.5 bar). The firebox is 7ft x 7ft (approx. 2m x 2m) and the boiler contains about 2,000 gallons (9,092 litres) of water. It is one of the few hand fired water tube boiler still in use on land in this country.

The pressure gauge on the front of the boiler cylinder shows the steam pressure, with the red line at 80 lbs/square inch, to show the maximum working pressure. On either side of the pressure gauge a sight glass shows the level of water in the boiler, the most vital job of the stoker is to ensure that the boiler never runs dry! Two safety valves are fitted to the boiler and lift at 83 lbs/sq. inch (5.7 bar). The boiler has an annual safety inspection and the safety valves are tested at least once each steaming.

Steam is fed from the boilers to the various steam engines working on site by large pipes running from the crown valve on top of the boiler. These pipes are heavily lagged to stop energy loss by cooling. The green pipe running into the front of the boiler feeds water into the boiler. The water has to be at a higher pressure than the boiler and is forced in by a feed pump in the main engine room. When in steam a gauge on the wall shows the water pressure.

A steam whistle is fitted to the boiler, this came from the Gas Works next door and was used to signal shift changes and meal times. Yes, it is operated with an old bell rope.

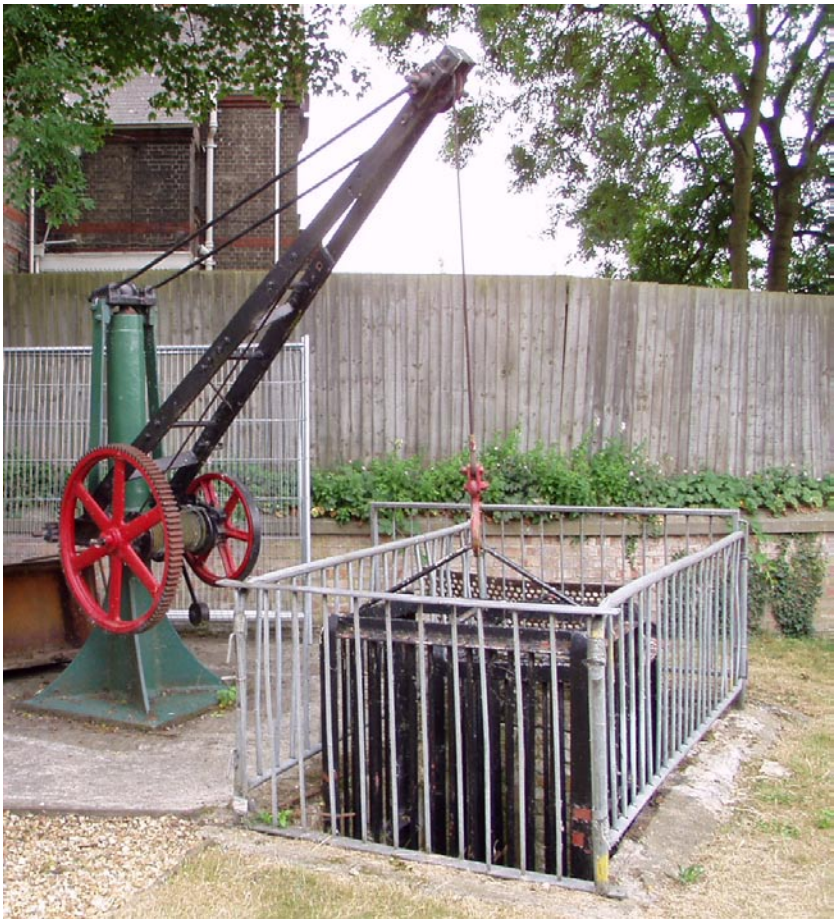
The badge on the centre of the left hand white area on the boiler giving the manufacture's name and installation date.

The Lower Site

The area outside the buildings on the lower part of the site houses a number of exhibits.

Cage Crane

The small crane is an original part of the equipment of the pumping station and was used to raise the “cages” next to it. These acted as filters and were fitted with screens which prevented rag and other objects from fouling the pumps. They had to be lifted twice a day to be cleaned. The crane was operated manually until 1956, when an electric motor was fitted. One screen was cleaned at 9 am, the other at 4 pm.



Pump Piston

Near to the crane there is a Foot valve removed from one of the pumps operated by the steam engines. Its size gives some idea of the size of the pumps.

Note the 6 rubber sealed one way valves. Until 1909 the seals were made of leather.

As the pump bucket moves downwards the valves open and sewage flows through the valves. When the pump bucket moves upwards the valves close and the sewage is lifted up.

Wooden Water Pipe

This is to be found in the Ash Tunnel.
From an early water main in London.

Fire Pump

Although this item was not part of the sewage pumping station, it is displayed here as an example of a steam pump.

The steam powered duplex fire pump mounted on a plinth was manufactured by Mather & Platt of Manchester in about 1910. It was installed in the former Fosters Flour Mill (later, Spillers) in Station Road, Cambridge and was acquired from there by the Museum when the mills were closed.

Mill Stone

This mill stone was not part of the sewage pumping station.
It is displayed here as an example of industrial archaeology.

This stone came from a watermill at Wimpole. It was the top stone of a pair. To grind grain into flour a watermill (and windmill) have a pair of stones. The lower stone is called the bed stone and is set in the floor and does not rotate. The stone here is an upper stone which does rotate and is called the runner stone.
The lines cut into the surface do the grinding.

One Man Air Raid Shelter

Also on the lower site is a small air raid shelter used on exposed sites such as docks or railway marshalling yards where people might be caught a long way from normal shelters. These were also called Consol Firewatcher Shelter. The base dimension is small so the whole shelter can be placed up on a roof. This one was manufactured for use in the Second World War but was a First World War design. It was subsequently used to store ice at the farmer Mac Fisheries shop in Petty Cury Cambridge.

The air raid shelter, though claustrophobic, would give a degree of protection from flying debris during a bomb raid in wartime.

The wording on the bottom of the label reads :-

CONSOL PORTABLE SHELTER

K2 B.C.M. SLOTS LONDON

The armoured figure on the door (right) could keep you company

Tramway Rails

The rails mounted in wooden blocks beside the air raid shelter came from the Cambridge Street Tramways.
The tram system in Cambridge opened on 28 October 1880 and closed as the result of financial problems on 14 February 1914. The line ran from the railway station to a junction at Hyde Park Corner, the cross roads where the dominant Roman Catholic church stands. From there lines ran along Gonville Place to the company's depot in East Road, another along Regent Street and St Andrew's Street to a point opposite Christ's College and third via Lensfield Road, Trumpington Street, King's Parade and St Mary's Street to Market Hill. The trams were horse-drawn, proposals to introduce electric trams never passed the planning stage.

The track was of 4ft gauge and very heavily constructed for a light tram track. The tracks here come from the curve from King's Parade into St Mary's Street and were unearthed during road works in 1976. The wood blocks are also original.

Vertical Steam Boiler

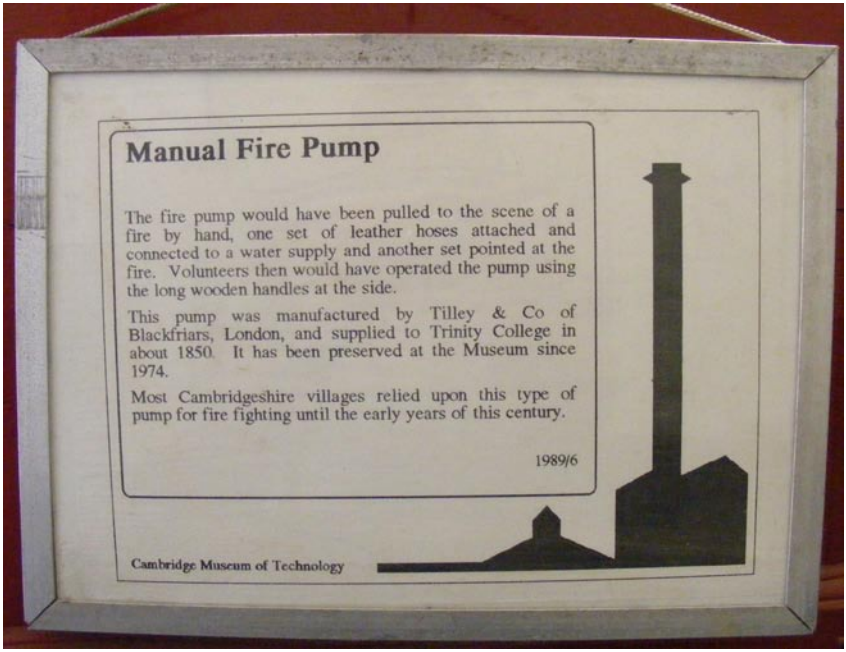
Beside the tram rails is a vertical steam boiler.

It was used for steaming pig swill at a farm near Pymore.

Manufactured by Barford & Perkins of Peterborough. See the name on the ash door

Manual Fire Engine

On most occasions when the Museum is open a manual fire engine stands in the yard, otherwise it is located nearby in the Ash Tunnel. It was manufactured by Tilley & Co of London in 1855 and supplied to Trinity College. Its age means that it is now very fragile and can no longer be operated. Please do not allow children to climb or play on it.



City of Cambridge Boundary Sign

A place name sign was positioned at the entry of each major road into Cambridge. The colourful central coat of arms depicts the lost Norman Cambridge castle, the Great Bridge (Magdalene Street) and over the river Cam - from which Cambridge derived its name and trading ships indicating that Cambridge was an inland port.

Gas Pipe

When the Great Bridge was strengthened in 1972/3, this gas main pipe was removed. The Gas authority spokesman confirmed that :

> It is a unique design as it was specially constructed to fit the contour of the bridge and weighs a little more than 2 ½ tons and is 35 ft long.

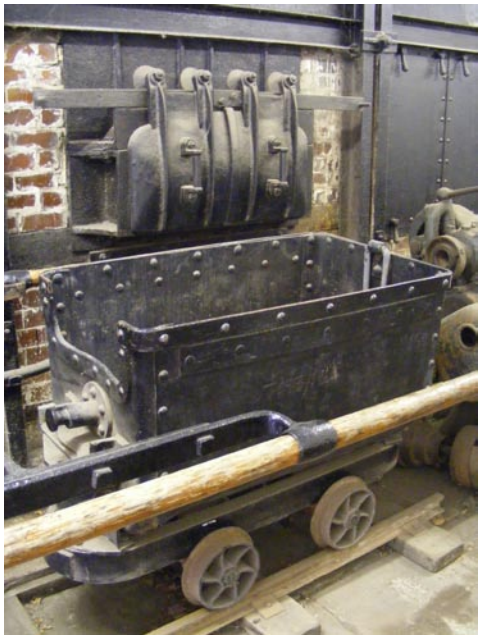
The early gas main clearly shows the arc to fit the curved contour of the Great Bridge in Magdalene Street Cambridge.

Weather Station

This housed two instruments;
the one on the left measured and recorded temperature – a thermometer; the one on the right measured and recorded atmospheric pressure – a barometer.
There were two stations for public information : one on Chesterton Road near Jesus Green footbridge over the river Cam and the other in the churchyard of Great St Andrew's. The recorders were of the cylindrical chart type driven by a clockwork motor.

Typically if the barometer is falling, deteriorating weather or rain is indicated; if the barometer is rising, fair weather is likely.

The Ash Tunnel



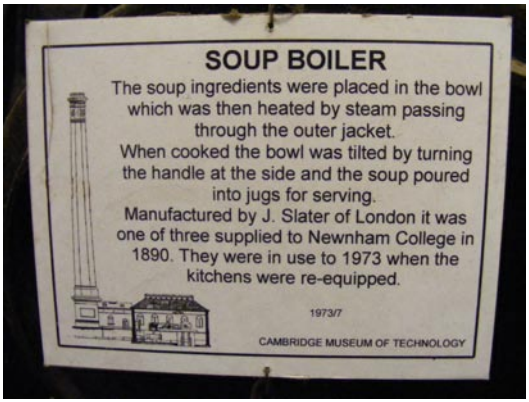
Here the ash and clinker were raked out of the grates of the boilers destructor cells. The clinker, very hot and often smelling unpleasant, was pulled down into tipper trucks running on the rails immediately beneath the sliding doors of the furnaces. The full trucks were pushed by hand along the rails to just past the building now used as the Print Room. Here they were swung round 90° on the small turntable on to the rails running up to the top of the site. The steam powered winch pulled the trucks up these rails by means of a cable.

Once at the top the trucks were pushed by hand over a series of branch lines to be emptied, the ash being used to fill in the numerous brick pits in the area. After the ash had been tipped out, the trucks were rolled back down the track using the winch as a brake. The ash railway has now been rebuilt and is operated on steaming days.

In the ash tunnel, the small trough in the floor on the opposite side to the boilers was filled with water to cool the iron tools which had got very hot in raking out the ash and clinker.

Some Items in the Ash Tunnel

There is a number of items on display in the Ash Tunnel, including a toothbrush making machine and a steam heated soup boiler. The Tilley fire engine is housed here when not on display outside.



Chimney

The chimney is a Cambridge landmark. This is 173 ft high (53 m), the height is needed to create sufficient draught for the boilers to operate efficiently. Iron reinforcing bands were added in the 1950s, and maintenance work carried out in 1985. Further maintenance work was carried out in 1992 by Fred Dibnah, renowned for his televised steeplejack skill and his restoration of steam engines.

The Print Shop

Housed in a former workshop is a working exhibition of letterpress printing equipment from hand-operated presses to powered machinery including hot metal typecasters. The printer will be pleased to answer your questions, demonstrate the equipment, and help you print your own souvenir of your visit.

Cast Iron Fence Posts

At the top of the steps are three cast iron fence posts. These were produced at local foundries, one by John Hart of Cottenham and two by Headly & Edwards whose foundry was at the junction of Newmarket Road and Cheddars Lane. Occasional posts and bollards made locally can still be found around the streets of Cambridge.

Street Name Plates

These are made of cast iron and are of a design particular to Cambridge.
A lot of streets are named after a person, for example : -
GILBERT ROAD – William Gilbert (d. 1603) of St John's College was the author of an important early scientific book about magnets and the earth's magnetism.

Top Site

Blackstone Shed

This small brick building has been converted to represent a typical Fenland pumping station of the 1920s and 1930s.

The big engine is a Blackstone Oil Engine type ESI (i.e., size 'E', spring injection) and, together with the Blackstone Unchokable Pump, came from the Milton Sewage Works where it had been installed in 1926. There are also other smaller engines in the shed.

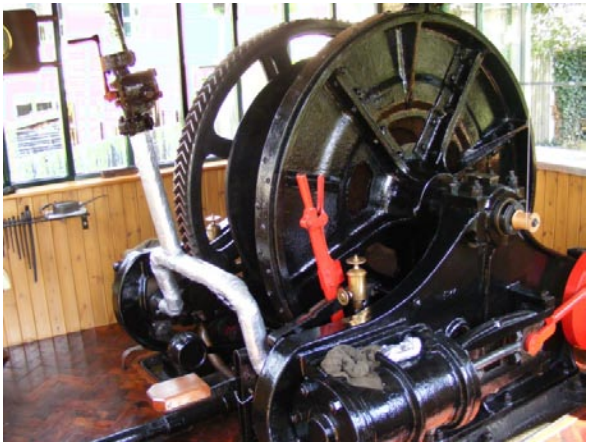
This building is also known as the Baling Shed. When the town's rubbish was used as fuel, the rubbish was first sorted to remove metal and glass, which would clog the furnace. The metal from the rubbish were compressed and then gathered together into bales which were sold as scrap for recycling. There is evidence through an old photo of a steamroller being used to flatten rubbish such as tin cans. The glass was dumped, some of it on site. During building work on site a number of glass bottles were recovered and are on display in the Portakabin.

Ash Railway / Winch Engine House

This engine house is a recreation of the original house which was demolished in the 1950s. The bunting was for the 40 year celebration (Aug 2010) of the museum when the mayor opened the engine house.

The winch hauled railway skips full of ash to the top of the incline where the ash was empted.

The engine is a Horizontal Duplex Steam Winch Engine made by J Wilson & Co of Liverpool in about 1904.
It was donated by British Coal and came from the Tilmanstone Colliery in East Kent.

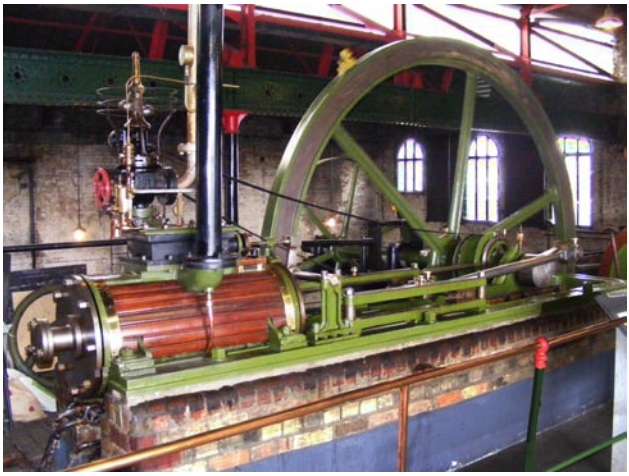


Top Bay

The top bay was the area where all the refuse for incineration was tipped from the rubbish carts. Both it and the destructor floor were originally open to the air to try to improve working conditions, the heat and smell otherwise making conditions very unpleasant. The wooden walls and doors and the roof were added in 1939 as an air raid precaution; as the destructor furnaces were top fired they threw a glare upwards that would have provided enemy bombers with a perfect landmark for the important railway goods yards in Cambridge.

Today it houses some of the museum's growing collection of engines and other industrial equipment. Some items are awaiting, or are under, restoration.

Headly Mill Engine



The most striking exhibit is the mill engine which was built in Cambridge in the mid 19th century at the foundry of J I Headly. It was supplied new to Thomas Evans Leatherworks in Sawston where it drove machinery until 1968. It was dismantled and moved to the Museum in 1970 where it has been re-erected and restored to working condition.

Beam Engine

In one corner of the top bay is a small beam engine which is run on a steaming day.
A full size beam engine is a massive machine standing about 30 ft high. You can see a full size beam engine at Stretham Old engine, which was used to drain part of the fens.

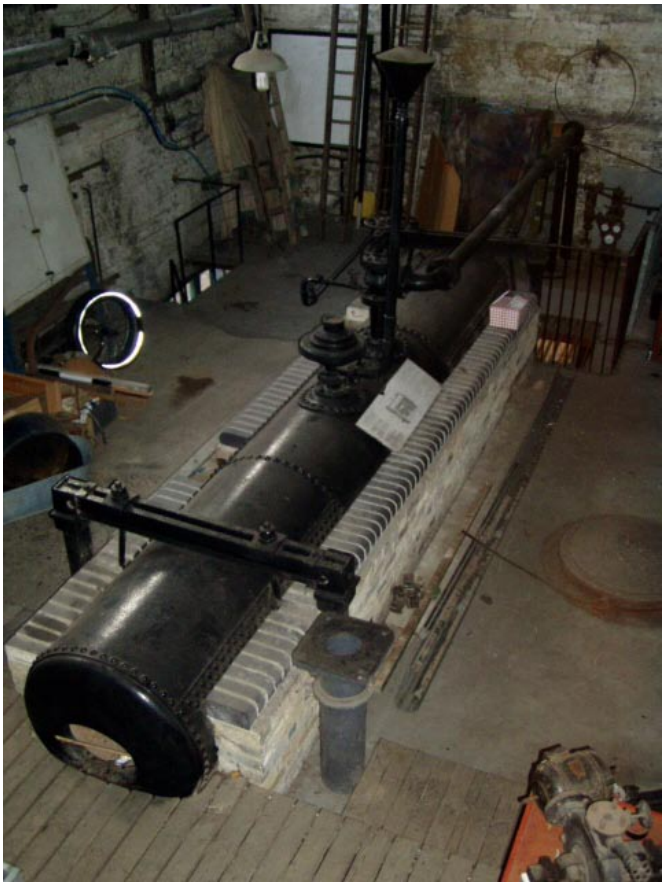
Water Pumps

These are fun to play with and are very hands on.
On open days the pumps are outside and filled with water.

Archimedean screw pump

Charge Floor

The area beyond and below the Headly engine is the charge floor for the destructor furnaces, not normally accessible to visitors. The refuse was tipped down on to this floor from the top bay, and shovelled into the stoke holes of the furnaces. Inside a furnace the fuel fell onto a brick platform where it dried. It was then pushed onto the grate for burning.



The long black object is the top of the boiler cylinder of number one boiler. The stepped cone shape is the safety valve and the pipe work comes from the crown valve where the steam was drawn off.

Museum Shop

The brick extension housing the Museum Shop was built in the 1950s to house electric de-oiling equipment for the boiler feed water. All the equipment is now gone.
Now it serves as the visitor reception for sale of admission tickets, books and souvenirs of your visit, and drink, confectionery and light refreshments.

The Museum is a Registered Charity number 311310.
It is run and staffed entirely by volunteers.

Written by Bob Flood
Photos & Booklet David Stubbings
Aug 2010, Ver. 5 Oct 10, Ver. 6 to IDBE 7 Dec 10

To find out what events are planned visit our web site
http://www.museumoftechnology.com/index.html

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Cheddars Lane
Cambridge
CB5 8LD

Telephone 01223 368 650 (answering machine only)

Site Plan

Blackstone engine shed

Toilets

Men's by the print shop

Ladies' off the main engine room

Light refreshments are on sale in the shop