



Waterworks Museum - Hereford

The Gilkes - Francis Turbine and the story of Kington water supply

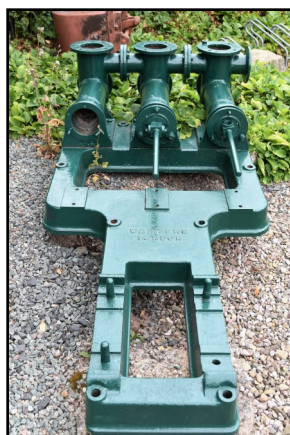
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How static exhibits can have an interesting story to tell

This research sheet uses two static exhibits to tell the story of public water supply in Kington, Herefordshire since the 1830's. A water turbine manufactured by Gilbert Gilkes & Gordon Ltd to the Francis design and the triple throw pumps it powered, both of which were installed in Kington's Crooked Well pumping station in 1937.

The water turbine became a back up power supply after an electric pump was installed in 1951 and the turbine and the pumps were removed from the pumping station after 1977 when new arrangements were made for Kington's water supply by the Welsh National Water Development Authority, a predecessor to current water supplier, Dwr Cymru Welsh Water.



Left: the Gilkes - Francis turbine, which can be seen in Bay 2 at the Museum, It was powered from a weir on the Back Brook, a tributary of the River Arrow, the remains of which can still be seen today.

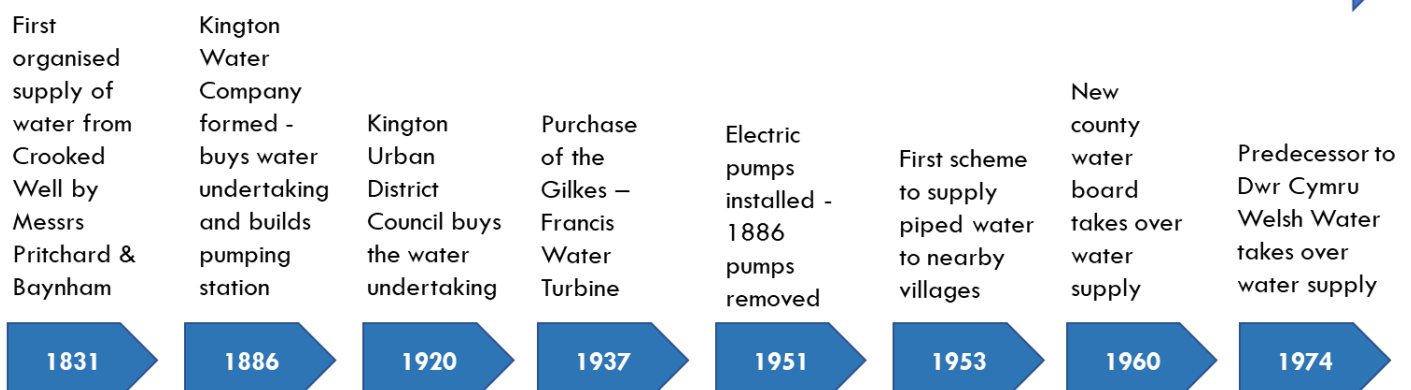
Right: the triple reciprocating water pumps that were driven by the Gilkes - Francis turbine can be seen in the Museum courtyard.

Gilbert Gilkes & Gordon Ltd is a privately owned pump company that still operates today as a hydro-power engineering company.

In 1881 Gilbert Gilkes & Co bought the agricultural engineering business of the Williamson Brothers in Kendal in Cumbria, This company had been founded in 1853 and built its first turbine in 1856. In 1878 it had supplied the pumps for Cragside, Northumberland, the first house in the world lit by hydropower.

The company became Gilbert Gilkes & Gordon Ltd after it acquired James Gordon & Co in 1932, five years before the Gilkes - Francis turbine was built.

The development of public water supply in Kington, Herefordshire



This information sheet draws together earlier research by former trustees Alan Shaw, Noel Meeke and the author with more recent research in particular drawing on press articles in the Kington Times newspaper (1915-1959)



Kington Water Tower
in January 2024

Kington's earliest organised water supply

This is described in Parry's history of the town as commencing in 1831 when Messrs. Pritchard and Baynham purchased rights from Lady Greenly of Titley Court, to erect works to extract water on a site near Crooked Well.

"The machinery is set in motion by a waterwheel, with a beam lever attached, and the water is propelled

through leaden pipes to a large cistern, near the church, from whence it is carried by branch piping to several houses in the townships of Old and New Kington. The charge made by the proprietors for a good supply of this excellent water is very moderate."

The waterwheel, one of several in the town was leased at 30 shillings a year.

The pumps supplied water via a 2inch pipe to a 600 gallon tank at the top of a stone and brick water tower on Castle Hill near the Church. This water tower can still be seen today.

This first water supply, however, was available to very few households and this position did not improve for many years ahead.



The pump house at
Crooked Well (1973)

Kington Water Company

A public company to supply water to Kington was first proposed in 1846 but it took another 40 years to become a reality.

Kington Water Company was formed in March 1886 when it purchased the assets, machinery and goodwill of the water works from the Baynham family for £1,000. It also acquired the land (and rights to the freshwater spring) at

Crooked Well from Mr. Greenly of Titley Court for £50.

A new reservoir was built at The Wych, south of the Church, and new mains were laid at a total cost of £680. The reservoir was doubled in size in 1894.

In 1895 water mains were laid throughout most of the town and a small extra pump set was installed to cope with the demand.

Crooked Well pumphouse was built in 1899 to house a second waterwheel, a Jonval type turbine and pumps made by *J. Warner*. A steam engine was added in 1902 to drive the pumps when water in the Back Brook was low.

In 1855, London based hydraulic engineers *John Warner & Sons* cast the bells for the great clock of the Houses of Parliament, now known as 'Big Ben'.

Funding public works

A council could only borrow money to purchase privately owned assets, interest on which would be paid via the town rate, with approval from central government after a public inquiry to look at the need for and level of investment required.

Two such inquiries were held in respect of the Kington water supply before the purchase was completed in November 1920.

Kington Urban Council purchase of the waterworks

By 1908 the Council had started to look at other sources of water after years of inclusive discussion with Kington Water Company about the speed of growth of its supplies. Around that time over 150 properties in the town still did not have a water supply.

The Council enquired at what price it might buy the water undertaking but refused to pay the £9,000 then asked for it.

By 1910 it was clear the most credible alternative

source of water, a spring at Woodville, did not have the capacity needed to meet the needs of the town so a purchase was the only way forward.

The engineering firm of Glenfield Kennedy & Co was engaged to review the water undertaking, which led to further discussions about price. In November 1911 a Local Government Board inquiry was held to consider a requested loan of £6,000, including £5,500 to buy Kington's water undertaking.

But the purchase did not proceed at this time.

The water undertaking was eventually bought for £4,500 in November 1920 (after a second inquiry in May 1920).

The Council needed consent from the Ministry of Health to proceed but did not need a government loan for the purchase. By the time of completion it had successfully raised a loan of £4,600 by local subscription, just £150 short of the sum needed for the purchase and ancillary costs.

Later improvements to Kington's water supply

By 1923 the works had a National Gas Engine to power the pumps in times of drought. This worked with the steam engine to ensure continuous supply.

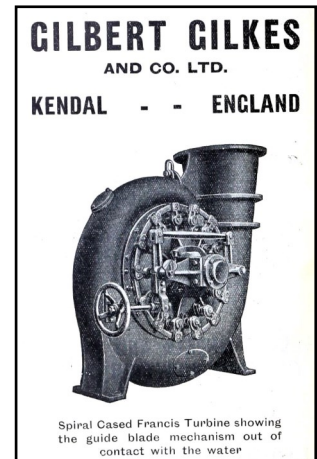
In 1924 the reservoir was covered after the Ministry of Health advised this to prevent pollution. This cost £100. For the first time piped water never saw the light of day until the customer turned on the tap.

In July 1937 the Council approved the purchase of a 4 BHP Gilkes Francis turbine from Gilbert Gilkes & Co Ltd. This followed years of high maintenance costs and an engineering review that confirmed the existing method of pumping was best for Kington but it assessed the 40 year old Jonval turbine to be beyond economical repair.

The cost was £260 funded by a Ministry of Health loan of £300, which included funding for an improved supply to the higher parts of the town.

In October 1951 an electric pump was installed at the waterworks.

This continuous investment in pumping was essential as



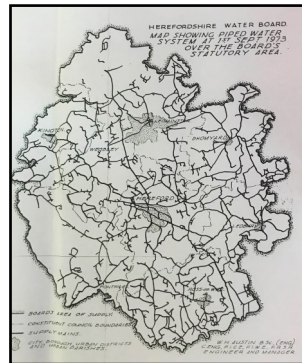
Water supply to the villages near Kington

The villages in the area of Kington Rural District Council had to wait until the 1950's to receive a piped water supply. Prior to that they relied on locally managed spring supplies.

In May 1953 a £93,200 scheme was approved to supply 12 villages. It had five piped networks, three supplied from the Crooked Well and two from a spring at Shobden Airfield.

This was the first comprehensive scheme of its type in the county.

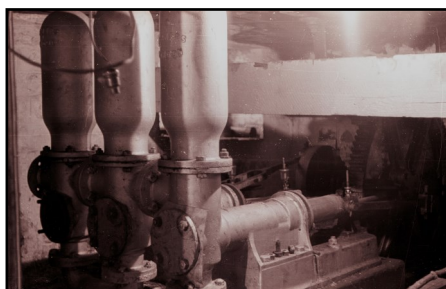
Other villages and rural areas had to wait until the Herefordshire Water Board (HWB) was created in 1960 to get a piped water supply. Within 6 years of its creation the Board laid over 350 miles of water main, delivering water to some 25,000 people previously without mains supply.



Map showing the extent of piped water supply in September 1953.

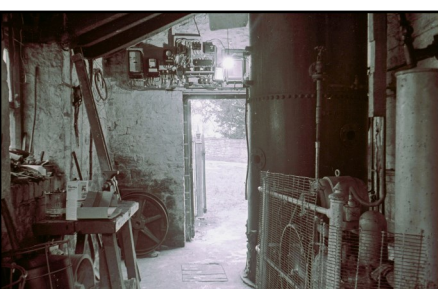
The villages that received their first piped water supply under the scheme approved in 1953 were:

Eardisley, Willersley, Winforton, Whitney Court, Huntingdon, Lower Hergest, Lyonshall, Pembridge, Staunton on Arrow, Byton, Kinsham, and Combe.



These images of the pumping station at Crooked Well, Kington were taken by Museum Curator John Townsend in August 1973 prior to the removal of the engines and pumps.

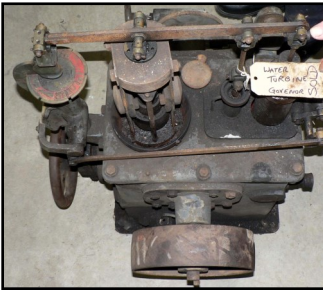
The images are from the John Townsend Collection.



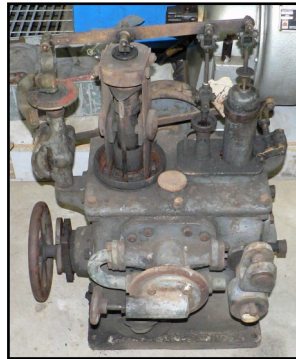
The 1937 Gilkes - Francis Turbine

The turbine and pump set were donated to the Museum in 1975 by the successor to the Herefordshire Water Board. Before the machinery was disturbed a number of photographs were taken by Curator John Townsend showing the Crooked Well pumping station and the machinery in situ. Only then was the turbine moved to the safekeeping of the Museum.

The restoration for display was not begun, however, for over ten years. The turbine was in a very rusty condition and needed to be cleaned with a pneumatic needle gun before it was dismantled with the aid of jacks and a car engine hoist suspended from a steel access tower erected over it. Several of the links operating the guide vanes of the turbine were missing and the original handwheel operating them was badly damaged and had to be replaced by our volunteer engineers.



Part of the water turbine as it came out of back store



Maintenance on the water turbine's regulator in 2010



The Kington triple throw pumps being repainted in 2019

The Gilkes - Francis turbine was installed at Crooked Well in 1937 replacing the earlier turbine installed by the Kington Water Company in 1886, which was of the Jonval design. The difference between these turbines is broadly described in the next column.

Turbine technology explained

Water turbines may be broadly divided into two main types: impulse and reaction turbines.

In the impulse turbine the whole head of water supply is converted into kinetic energy before the wheel is reached. Jets of water, directed by stationary nozzles, impinge on a series of buckets attached to the periphery of the moving wheel. In an impulse turbine there is no variation in pressure as the water passes around the buckets. The best known example of the impulse turbine is the Pelton Wheel, which was invented in America in 1884.

In a reaction (or pressure) turbine the moving element is a runner (shaped like a wheel) provided with vanes into which the water is directed over the whole of its periphery by a series of guide vanes. The runner is always full of water and a drop in pressure occurs as the water is forced through them. Pressure energy is thus continuously undergoing conversion to kinetic energy not only in the stationary guide vanes but in the runner itself. This increases the efficiency of the turbine to around 90%, compared to 85% for a Pelton Wheel.

The attributes of reaction turbines - their smaller size, higher speed and power, lower cost and their ability to operate efficiently at variable water levels - meant that they soon replaced the traditional (vertical) waterwheel as the primary source of power for many industries, including water pumping.

The first commercially successful reaction turbine was invented by Frenchman Benoit Fourneyron in 1827. His turbine was arranged with the guide vanes inside the runner, the flow of water being radially outwards from the centre of the runner.

In 1837, another Frenchman, Feu Jonval, invented the Jonval turbine, which (amongst other things) incorporated curved vanes and guide vanes.

However, in the Francis turbine, developed in 1848 by English born American James B Francis, the water flows radially inwards towards the centre. Once the water has flowed through the turbine it exits around an axis parallel to the rotating axis. This gave the runner a spiral or twisting shape, which some describe as slightly resembling a snail shell.

The design of the Francis turbine enabled it to work equally well when positioned horizontally as it did when placed vertically. It also became recognised as the most efficient turbine when operated at less than full flow.

The Waterworks Museum displays a working model of a Pelton Wheel and has a fine example of a Fourneyron design turbine, made by Easton Anderson Goolden, which can be seen in a powered display at the back of the Museum.