

The History of Water Heating/Part One

To live, primitive man needed an adequate supply of fresh drinking water, food and a place to shelter.

Early civilisations, like those of Minoan Crete and of Rome, recognised these basic needs. Their houses had openings to admit light and air, heating was provided where demanded by the climate. Water supplies were laid on to towns, and primitive drainage and sanitation often existed. They also recognised the magic of hot water. They discovered natural hot springs and bathed and played in the waters. Where no springs existed they learned to heat water by artificial means.

It was Roman engineering genius that first truly developed the technology to heat large volumes of water. But the practice of bathing (at least in Europe) was largely forgotten with the decline of the Roman Empire. It was not revived until the Middle Ages but again faded when public bathing was judged (and often was) immoral. Private bathrooms and bathing pavilions became popular during the Renaissance. However, the benefits of hot water for domestic purposes became more apparent and gradually available from the mid-19th century. This time it was Victorian technology that produced hot water boilers, piped systems, sanitary ware, taps and the first geysers. It was to take a further century of steady engineering development to make hot water as readily taken for granted as it is today.

Hot water in Roman times

It is believed that as long ago as the third century BC, underfloor heating was used in bathrooms in the Indus Valley. But the Romans were the first great heating engineers. What is not so well known is the extent of the water heating systems employed in their large thermae, or public baths. For example, the Baths of Caracalla in Rome (AD 216) covered an area of some 120,000m² (about 30 acres) and could seat up to 1,600 bathers. Unlike Aquae Sulis in Bath, there were no natural hot springs and the immense amount of water in the baths was heated by fires.

The Baths of Caracalla had 28 heating chambers, each of 127m² floor area and each holding 1,160m³ of water, heated by a hypocaust, or underfloor hot air system. This alone was insuffi-

False dawn



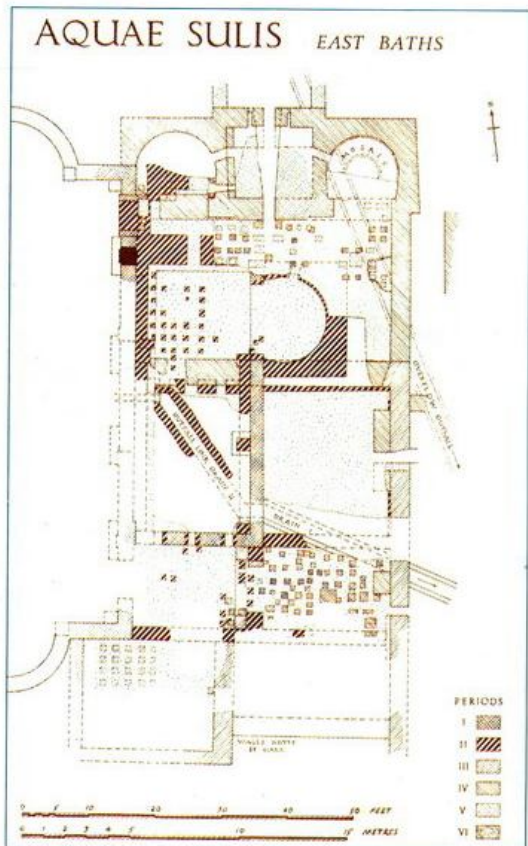
cient. So the Romans devised an ingenious heat exchanger, called a miliarium, comprising a brass furnace surrounded by a leaden vessel filled with water circulating from the pools.

Tin brass pipes, called dracones, led from the perimeter vessel of water to the core of the furnace and formed a heat exchanger to heat the water.

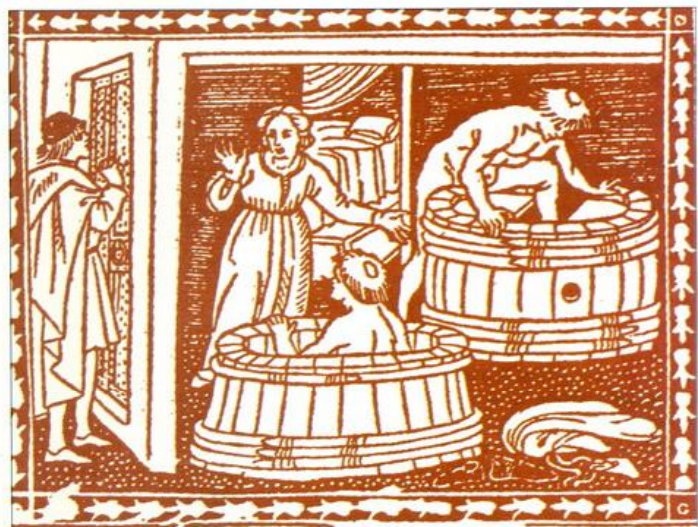
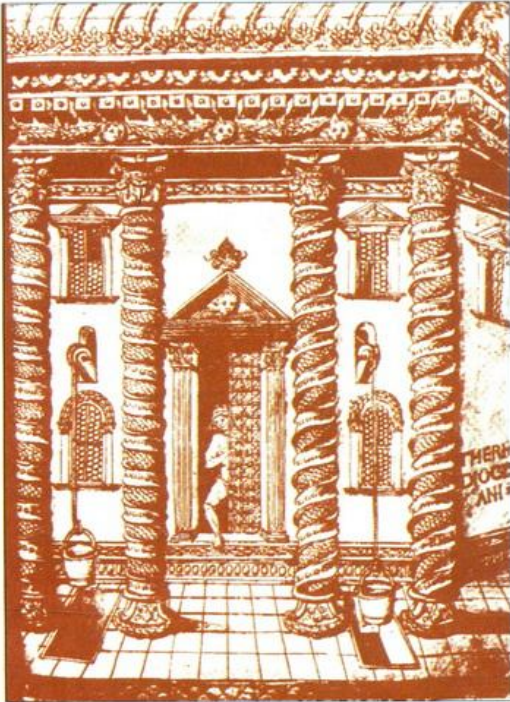
Bathing was a well-developed social habit in ancient Rome. As the Roman Empire developed and expanded, their baths became larger and more elaborate and also more formalised in their design. This can be seen in Hadrian's Baths at Leptis Magna, now in Libya, (AD 127). It is said the latter could accommodate some 3,000 bathers. At the other end of the scale, the water for the small baths in Roman villas could be heated by a brazier, or using an 'instantaneous' device, described by Seneca as a 'once-through' spiral copper pipe through which the water flowed, the pipe being heated by the flames of a fire.

Medieval to Regency times

With the decline and fall of the Roman Empire the practice of bathing seems to have been largely



The History of Water Heating/Part One



forgotten until the Middle ages. It is recorded that there were 32 public baths in Paris in the 13th century, while in London the delights of the Turkish bath were introduced by returning Crusaders. By the reign of Richard II (1377-99) there were 18 public bath houses, or stews, in Southwark alone, all making a handsome profit from the immoral business done on the side. The stews were finally closed down by Henry VIII.

Islamic


The Muslim bath, or Hamman, is believed to be directly inherited from the classical world, but from Islamic concern for both ritual and

cleanliness, rather than social and sporting aspects. There were also purpose-built bathhouses in India (an idea imported from Persia) where hot water steam became an essential way of life at the Mughal courts.

But it was the Renaissance in Italy which gave rise to sumptuous bathrooms and bathing pavilions. Taking hot baths again became a fashionable past-time of the nobility in Italy and in France. By the

18th century, a visit to a hot spa was considered the done thing, both in England and on the continent. On the domestic scene, a variety of baths appeared, but the height of rare luxury in Regency times was the warm bath, complete with both hot and cold taps.





**ANDREWS
WATER HEATERS**

Andrews Water Heaters. Look out for Part Two *Regency to Early Victorian* in the Winter issue of HAC

Enquiry N° 6

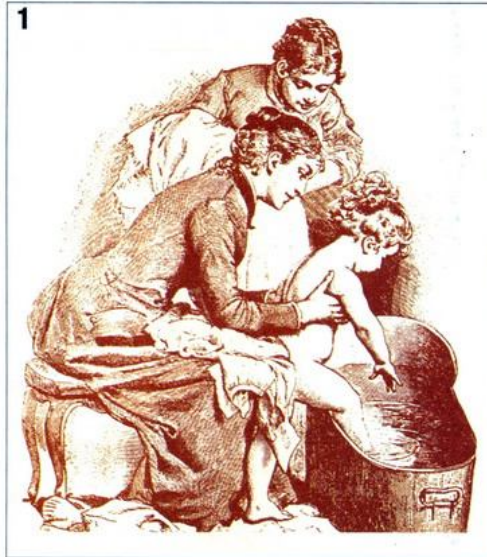
The Victorian era

by Brian Roberts, Chairman CIBSE Heritage Group

In early Victorian times taking a bath was almost unknown to much of the working class. Where public baths existed they provided cold water only. However, the Moorish, or Turkish Bath as it became generally known, was heavily promoted and became popular in continental Europe and in America. Britain lagged behind, but from around 1850 the idea of public baths combined with washhouses took off. It is believed the first were built in Liverpool.

Around the start of the 19th century, portable bathtubs could be hired in Paris from a man who toured the streets with a horse-drawn cart. His cart carried a supply of both hot and cold water. The whole family would bathe, one after the other in the same water (for refilling was too costly), and sometimes the water would be used for laundry as well.

In Britain, up to about the middle of the century, piped water was hardly ever available beyond the kitchen sink. A portable tub in the kitchen was the usual method of bathing. A few larger houses of the rich had a bathroom, but usually even this rarity had neither hot water nor drain. It was said that when Queen Victoria married (1840), there was only one bathroom in Windsor Castle. The English plumbing pioneer, Hellyer, wrote (1877), "In every house a WC may be considered a necessity. But by English people, lavatories and baths, fitted up with hot and cold services, would, I suppose, be considered a luxury." Lord Hamilton, writing of his visit to a large country house recalled his experience in the bathroom: "Switching on the hot tap produced a series of sepulchral rumblings succeeded by the



appearance of a small geyser of rust-coloured water, which stopped after a couple of minutes and was in any case stone cold."

From the 1880s a variety of ingenious (and often dangerous) types of apparatus for heating bath water were introduced. There was a directly heated gas-bath with the burner underneath the bath, then a portable bath with a paraffin heater, to say nothing of the French solid-

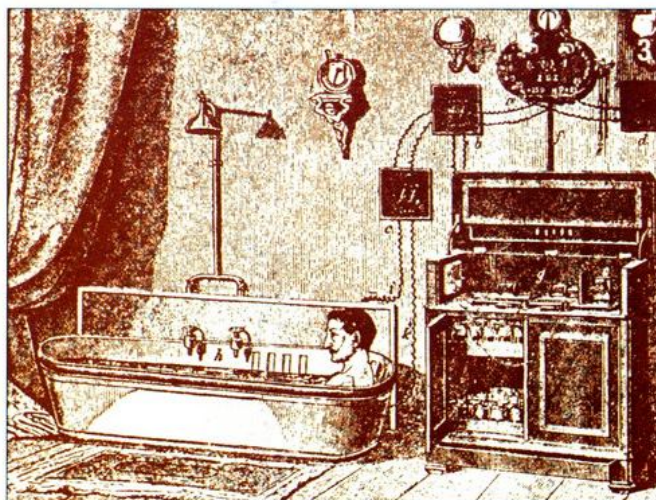
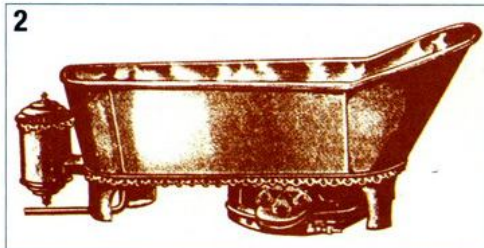
fuel water heater and bath, or the GEC electric bath installation.

Hot Water Apparatus

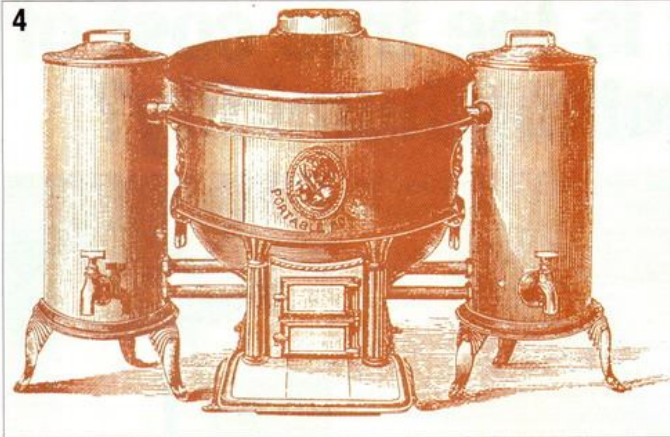
The middle part of the Victorian era saw the introduction of a wide variety of ways of heating hot water for domestic purposes. Kitchen ranges or ovens had been used to heat hot water since at least the 1790s. By the 1840s a large number were on the market; Brown's, Sylvester's, Deane, Dray & Drummond's Cooking Apparatus, Harrison's Economical Derby Range and many others. They operated on the principle, "cold water is piped in, hot water is then piped out." Many elaborate versions were available by the close of the century, for example, the Smith & Wellstood "Lioness" range with its 25 gallon open-top copper hot water cistern. The same company also produced a "circulating hot water attachment for either or both sides of Smith & Wellstood's Portable Boilers." The latter part of the century also saw the introduction of hot water circulating boilers and the "tank" system, where the boiler flow and return pipes were connected to the storage tank. This was soon superseded by the indirect cylinder method, still in use today.

The Geyser

However, the generation of domestic hot water was revolutionised in 1868 when a sign-writer and decorator by

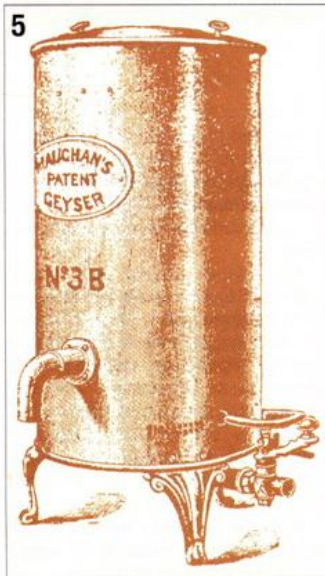
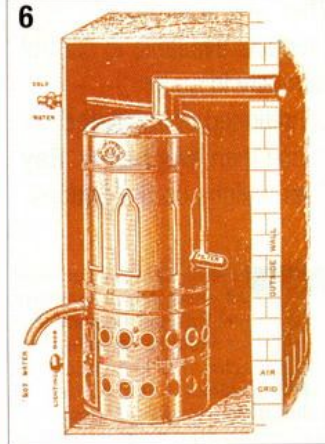


The History of Water Heating/Part Two



ILLUSTRATIONS:

- 1 Victorian Bath Night
- 2 Gas bath, 1882
- 3 Electric bath, 1886
- 4 Portable boiler with hot water attachments, 1890
- 5 Maughan's Class B Geyser, 1870s
- 6 Fletcher's instantaneous water heater, 1888
- 7 Fenlon's Patent Geyser, 1900



"Union" gas jets and then their special "geyser jets." The firm of Shrewsbury produced a closed type, floor-standing bath heater which employed Bunsen burners. Righton's made the "Rapids" open type water heater. This was followed by the popular "Lightning" geyser of the closed type by Ewatts.

Later, instantaneous water heaters, invariably described as "patent" were produced by firms such as Fletcher, Davis, Calda, Fenlon, Wright and others.

The Turn of the Century

By the latter part of the Victorian era, the growth of the town's gas industry and the wider availability of piped gas had made possible a considerable increase in the use of domestic hot water, at least in the homes of the middle and upper classes.

A catalogue of 1898 for Wright's Water Heaters neatly summarises the types of gas water-heating apparatus then available: "Water Heaters may be divided into several classes, ranging from the simplest form of boiler or hot-water cistern to the 'Instantaneous' Water Heater, or the

High Pressure 'Circulating' Boiler, by means of which a supply of hot water may be carried to all parts of the house, and connected to Baths, Lavatories, Kitchens, etc.

"For a 'complete' Cooking Range, it is generally desirable to have a separate boiler for the supply of hot water, though the facilities for boiling water on top of the 'Eureka' Cooker are such that a special boiler is in many cases not absolutely necessary. In selecting a boiler for this purpose, it should be borne in mind that, whilst it is a most useful addition to the Range, it may in the hands of careless servants, become an excuse for an extravagant consumption of gas.

"The economy of gas as a domestic fuel lies in the fact that it can be lighted in a moment and turned out the moment that it is no longer needed: hot water is useful at all times, and there is a temptation to keep the gas burning all day in order to have a supply of hot water at any time."

the name of B W Maughan invented the first instantaneous gas water heater. He called it a "geyser," and is said to have taken the name from the Icelandic "geysir" for a spring that discharges steam and hot water. Maughan was granted British Patent No.3917, dated December 1868, for his invention.

This first geyser was followed by his improved class "B" pattern, "constructed on the direct heating or open type principle having a series of small spiral wires down which the water trickled, and was heated by an ingenious burner consisting of small brass tubes which were needle-drilled and produced a number of perfectly even flames of the luminous type."

Soon, other firms started to make geysers, as the name had not been registered as a trademark by Maughan. These included Bray, with their



**ANDREWS
WATER HEATERS**

This article is the second in a series of four charting the complete history of water heating and sponsored by Andrews Water Heaters. Look out for the next issue of HAC for Part Three.

At the turn of the last century

by Brian Roberts, Chairman CIBSE Heritage Group

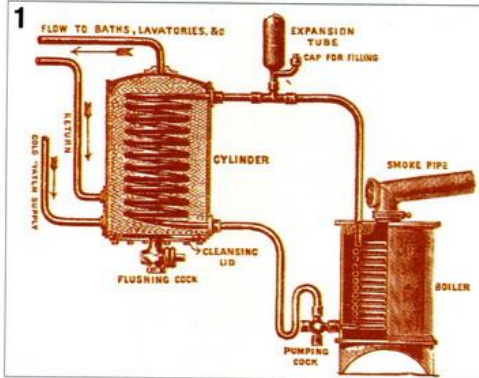
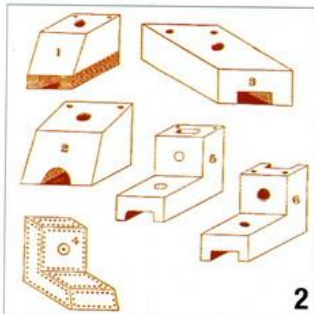
The close of the reign of Queen Victoria saw the development of hot water boilers, both for heating and for domestic and institutional hot water supply. Up to this time, steam boilers had traditionally been used in schools, hospitals and large buildings where heating, cooking and a motive power source (for driving engines or generators) was required.

Some of the first domestic hot water systems used storage tanks or direct cylinders, the water often being heated by a kitchen range or boiler. Once the problems caused by boiler scaling, due to the constant changing of water, were realised indirect systems were widely adopted.

Surprisingly, a number of early systems used high pressure hot water boilers and kitchen ranges to heat a domestic hot water indirect cylinder. These were derived from the system first patented by A M Perkins in 1831, and improved in 1839, using 7/8-inch bore high pressure seam-welded wrought iron tube. The high temperatures employed, as much as 170degC, and the high system pressures posed safety risks and this technique fell into disfavour with fire insurance companies, leading to its abandonment.

Hot Water Boilers

Boilers for the direct supply of hot water had to be specially

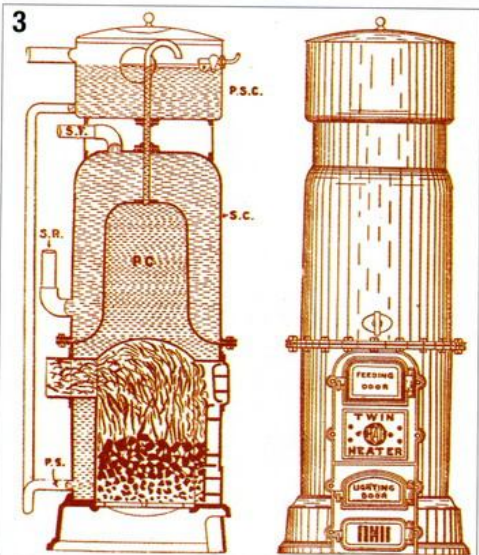


developed. As a heating textbook of 1904 records: "A coil boiler or any other form of boiler with small or contracted waterways is not suitable for direct hot water supply, because they are quickly choked with deposit." A variety of boilers in various shapes and sizes were available, constructed from cast iron, wrought iron or copper. Some of these, described in a plumbing textbook of 1910,

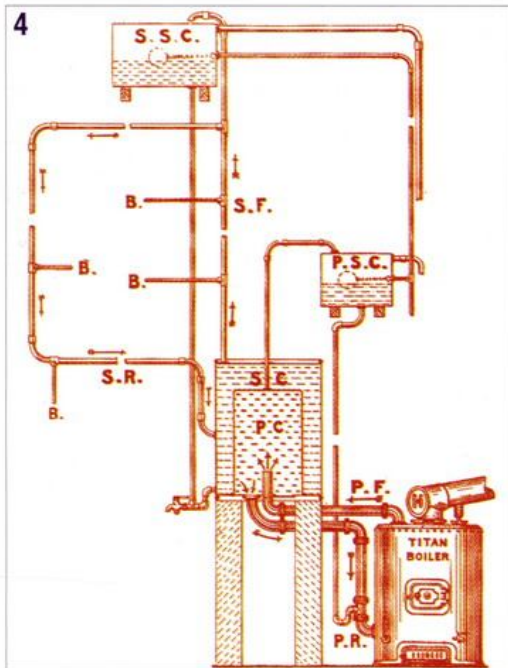
include the Rivetted Square Boiler (used with an open fire-place), the Modern Square Boiler and the Square Boiler with Arched Flue (used with a kitchen range), the Boot Boiler (technically a combination of horizontal and vertical Saddle boilers to double the heating surface), and the Independent Boiler. Of the latter it was noted, "These (Independent) boilers have only recently come into general use. The Boot boilers under ordinary circumstances have always been found so effective that the idea of having a boiler independent from the cooking range has only within the last few years been seriously considered. Independent boilers can always be recommended for large houses, mansions or hotels...."

Indirect Systems

Walter Jones, first President of the IHVE (now CIBSE), advocated the adoption of an indirect method of heating domestic hot water. "With indirect hot water supply the cost of upkeep in repairs or renewals is infinitesimal, the results obtained, and the convenience, more than compensate for the small extra cost....I am so convinced that the adoption of this system of indirect water supply would tend to prevent the disastrous boiler explosions, would meet a public want, and prove a great economy and convenience on the present wasteful system that I have designed and patented a combined boiler and cylinder (the Twin Heater), with the view of supplying a reliable and convenient apparatus that will occupy little space, and that can be readily fixed by any local heating engineer at a comparatively small cost." However, it was the indirect cylinder, usually located in the airing cupboard, with the boiler downstairs in the kitchen, that came into widespread use.

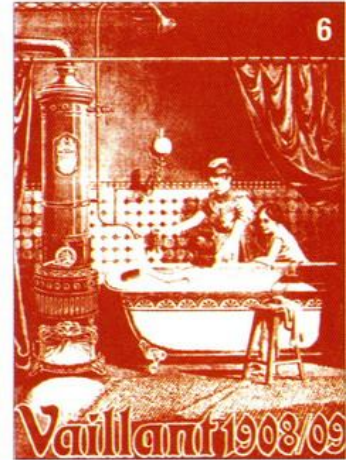


The History of Water Heating/Part Three



ILLUSTRATIONS:

- 1 Indirect Cylinder fed by HPHW Boiler
- 2 Hot Water Boilers. (1) Modern Square (2) Square with Arched Flue (3) Improved Saddle (4,5,6) Boot
- 3 Twin Heater Boiler
- 4 Titan Boiler & Double-Cylinder
- 5 Sandow's Curative Institute, Piccadilly
- 6 Vaillant Geyser
- 7 Ewart Radion Geyser



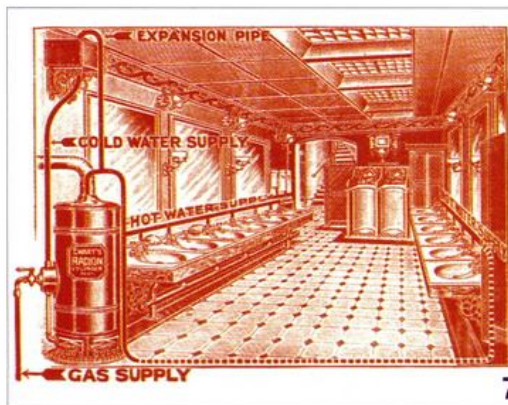
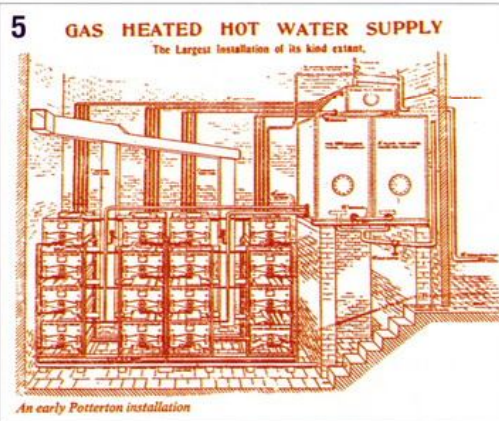
in conjunction with, or independently of, the boiler or kitchen range. A special style of geyser, such as the Acme of 1901, was arranged with two piped outlets capable of serving both a basin and a bath with a shower attachment. Others, such as the Vaillant of 1909, were designed as a combined water and room heating appliance, while the Ewart Radion could be used in a Gentleman's Public Convenience. The standard size geyser recommended for ordinary domestic use at this time was capable of heating four gallons per minute. However, the industry was still learning about the risks in these installations. Contemporary textbooks refer to the perils of inadequate draught, foul flue gases, frost damage, explosions, problems of lime deposit and rust formation, and how to size and locate water cisterns, cold feed pipes and expansion pipes.

A series of important experiments on hot water systems of the indirect cylinder type were carried out at Belfast University from 1902 to 1904. Water temperatures were measured at various points around the system, and the position of the flow connection to the cylinder, the arrangement of draw-off pipes, position of cold feed and the effects of dips in the flow and return pipes were investigated. A number of important principles were established: The primary heating flow connection should be at the top of the cylinder, which itself should be vertical to encourage stratification; the cold feed should be at the bottom and directed downwards to discourage mixing; and the secondary domestic hot water return is best of small diameter to minimise water movement. These findings are still valid today.

In 1909, the largest gas-heated hot water supply installation was claimed to be that using a group of 16 Potterton boilers at Sandow's Curative Institute in Piccadilly.

The Geyser

The gas-fired instantaneous water heater continued to be improved and its ability to provide hot water very quickly proved increasingly popular. In many houses, the geyser was fitted to existing circulating pipes to work in



This article is the third in a series charting the complete history of water heating and sponsored by Andrews Water Heaters.

Look out for the next issue of HAC for Part Four.