Public Health

In every house a WC may be considered a necessity. But by English people, lavatories and baths, fitted up with hot and cold water services, would I suppose, be considered a luxury.


(Presentation copy CIBSE Archives.)
Public Health

Ancient Rome (4th century AD) had 11 public baths, 144 public lavatories, 1352 public fountains and cisterns, 836 private baths, an extensive system of overhead and underground aqueducts, and public sewers. It was the Romans who installed the first piped supplies of water in Britain leaving examples of pottery pipes (Lincoln), wooden pipes (Silchester) and lead pipes (Bath). After the Romans, the larger monastic houses collected water from springs or reservoirs and distributed it through pipes, one of the most elaborate systems being that at Canterbury Cathedral (1160). London obtained its first piped water supply from a spring at Tyburn, from where it was distributed to a conduit at Cheapside (1237). Later, a waterwheel at London Bridge, drove a pump to raise Thames water into a reservoir, from where lead pipes took it into the City (1552). The New River brought additional water into London from Middlesex (1613), but a comprehensive network of water mains (and sewers) had to await Victorian times.

Wooden mains continued in use up to the 19th century, with lead connections into the houses. Gradually, other types of piping were employed: cast-iron (1743), steel pipes, pipes covered with a coal-tar composition against corrosion (Angus Smith, Liverpool, 1860) and concrete (1906).

The overcrowding and poor condition of many dwellings in London led to grossly insanitary conditions up to the mid-19th century. The privy, the cospool and the night-soil collectors took care of most sanitation requirements. It was Sir John Harrington who designed the first valve water-closet (1596), but it was not a success due to lack of piped water supplies and sewers. Though other designs followed, the breakthrough came when Alexander Cummings patented a closet which incorporated a water seal (1773). However, it still took around another hundred years before the use of closets became widespread and names like Jennings (1621), Doulton (1638), and Crapper (1685) spearheaded the sanitary revolution. In London, it was the construction of the intercepting sewer systems of Sir Joseph Bazalgette (1865) which stopped the wholesale discharge of sewage into the Thames. In places like Liverpool, it was the introduction of Building Regulations (1861) which improved sanitary conditions.

160. Liverpool Trough Water Closet. The scavengers are employed by the Corporation, and every day they visit each of the trough closets, flush it out with water, sweep it clean and leave it charged with fresh water for the next 24 hours' use.
[Prinç Council Medical Officer Report 12, App d 1870]. BSEP540.

161. Drainage of New Buildings, Liverpool. Section through a small, late 19th-century house in Liverpool showing here it should be drained.
[LA Manual of Building Regulations in Force in the City of Liverpool, W Golshirazi, 1902].
That the pipes that supply the bathroom burst
And the lavatory makes you fear the worst
It was used by Charles the First
Quite informally.
And later by George the Fourth
On a journey North.


163. Patent Vacuum Internal Closet. An overhead cistern closet (chain-operated) with glazed earthenware seat having a transfer applied pattern. Boxes of toilet paper were often included.
Toilet rolls date from c1880.
[Col: Doulton & Co. London, 1887.]
The Elements of Style, 1991, p.264.

THOMAS CRAPPER & CO.'S
Sanitary Specialities,

IMPROVED
LAVATORY BASIN.

White Ware, fitted with combined Overflow and Waste, and 4 Standard Screw-down Valves... £2 19 6
Plated Fittings, Extra... 0 8 6

ELASTIC VALVE CLOSET.
No. 78.—Valve Closet, with white china dish with gold lines, and handle, white ware flushing rim basin, 3 in. supply valve, copper air regulator, complete as shown... £3 9 6
If with 4½ in. valve: Ornamental Basin... 0 2 6
White and Gold Basin... 0 3 6
Box Enamelled inside... 0 4 9
Box fitted with Brass Top... 0 6 3
Box fitted with union to connect Ventilating Pipe... 0 3 9
4 in. outlet... 0 7 9

IMPROVED SYPHON
Water Waste Preventer.

Cast-Iron 2 Gallon Syphon Waste Preventer, with Tranquil Inlet Valve, and Silencing Air Tubes, and Brass Chain and China Pull... £1 1 6
Ditto, 3 gallon ditto... 1 3 6

60, 52, & 54, MARLBOROUGH ROAD, CHELSEA, LONDON, S.W.
166. Lead Pipe Making Machinery, 1883.
The Engineer: Highlights of 120 Years, 1975, p172.

167. Advert: Hot & Cold Water Tap, c1886.
Palatine Engineering Co, Liverpool.
Plumbing, Contingy issue, No.67, Autumn 1886, p10.

168. Shuns Pneumatic Sewage Ejectors. In 1886, a Select Committee of Parliament recommended that the drainage of the Palace of Westminster be pumped into the metropolitan system by Shuns's ejectors and that the main sewer passing under the Houses of Parliament be reconstructed on the most modern approved principles. This was accomplished in 1889.
The Roman baths in Bath date from 50 AD
(Plumbing & Mechanical magazine, USA, June 1993)
The History of Plumbing—Our Roman & English Legacy

from Plumbing and Mechanical, July 1986

The Roman answer to the hot tub—30 A.D., Bath, England

earthware, later refinement to lead made skilled workers in lead indispensable. The Latin term "plumbus" means "lead," as was also the weight at the end of a line for perpendicular alignment. The plumber was a worker in lead who, in today's connotation, repairs or fills the apparatus of water distribution in and to a building. The Roman artisan plumbed pipe; soldered, installed, and repaired, he worked on roofs and gutters, down to sewers and drains, in the most magnificent...walls covered with mosaics, perpetual streams of hot water poured into capacious basins through so many wide-mouthed vats and massy silver.

Miles from the source of supply, water flowed through a series of aqueducts, streaming by gravity along the contour of land. The longest overland section was about 14 miles long, but by 52 A.D., channeling covered a total of 220 miles—all but 30 miles underground. At its peak...
Roman & English Legacy

stepped down into it on two marble steps. A circular seat about 10' from the
bottom allowed the bathers to sit and wash themselves.

It was customary to bathe after exercise, and before a meal to promote
digestion. As just one example of his lavish excesses, it was Nero’s pleasure to
bathe, gorge himself with food and fancy
baths, etc. in his great gathered affairs.

In the cold water bath of Pompeii,
water was supplied through a bronze
spout, and wound its way through a
conduit on the opposite side. It was also
equipped with a waste pipe which
permitted the water from running over.

A marble platform surrounded the bath,
with pedestals for statues. The ceiling was
ventilated and lighted by a window in the
center.

By the 4th century A.D., Rome would
have 11 public baths, 3,552 public
fountains and cisterns, and 850 private
baths. In Pompeii, some homes had 30
taps.

As mentioned, the water supply was
provided by aqueducts, the first one built
in 512 B.C. Named in honor of its
originator, Apicus Claudius, it spanned a
total of 11 miles. However, it marked a
milestone as the previous water supply
was only from the immediacy of wells,
cisterns, springs, or the Tiber River itself.

As the city became more populous, and
the Roman emperors more decadent and
demanding, the engineering feats in water
systems became increasingly monumental.

An artificial lake created for Augustus
measured 1,800 long x 1,200 wide. One
of his favorite spectator sports was
watching actual battles between opposing
fleets of ships, manned by criminals and
slaves of the emperors. By Nero’s time of
37-68, A.D., a “sea fight” for his
amusement would utilize 19,000 men on
100 ships. They fought in gladiatorial
fashion, i.e., until one was killed in
combat, or spared by the emperor.

The English Connections: At the
height of its power the Roman Empire
had conquered most of Europe, including
about 1,500 sq. mi. of Britain, its furthest
outpost, and in the mines of Aquae Sulis,
the famed spa of Bath, lay the essence of
the rise and fall, and redevelopment of
plumbing technique.

By the time the Romans reached Britain
in 43 A.D., the cumulative powers of the hot
baths were already part of English legend.
Back in 865 B.C., the waters had
supposedly healed the leprosy of Celtic
discoverer, Prince bishops (the father of
King Lear), who was to be immortalized by
Shakespeare. Bladud founded the city of
Bath, and dedicated the springs to the
goddess Minerva. The Roman name of
Aquae Sulis means “Waters of Minerva.”

Aquae Sulis was at a strategic crossroads
for the Roman troops, and the natural hot
springs made it a logical setting for the
baths of the Emperor Claudius. In
addition, the springs produced a constant
supply of soothing mineral waters, heated
by Nature to a temperature of 46.5° C.

Important too was the available sources of
building stone and lead used close by.

Following Roman custom, Claudius
developed Aquae Sulis in the lineage of the
great baths back home, but scaled in size
to its smaller location. At that, the
complex must have consumed
approximately 75 acres

One monumental hall led into another
as the floor plan radiated to various heated
rooms, steam rooms, baths and swimming
pools, plus a gymnasium and social rooms
for eating and drinking. A playground
was attached to the complex as well.

The small, circular pool was probably
built for women and children, who at first
used the pool only at stated hours and
separate from the men, but eventually
regulations broke down and both sexes
intermixed throughout the pleasure
complex.

The Romans controlled the site for
about 500 years, but their influence
flourished, waned and just about
expired in phase with the decline of the

Right: The first notable toilet design was by
the “father of the modern water closet,”
Alexander Cumming. He announced his
patent in 1775. The bowl held water by
means of a sliding valve underneath.
The lever operating the valve admitted water
from the cistern. Cumming’s “self pipe” was
really an S-trap offering a certain syphonic
action.

Below: In 1595 Sir John Harrington
installed the closet in his home. It was called the
“Ajax” in England for “a jakes,” common words
for a toilet back then.

54 Plumbing & Mechanical, June 1993
Empire, whose reputation became complete by the sixteenth century AD, by then Roman garrisons in Britain had been invaded by tribes of Picts, Saxons, Scots and Irish, and could count on no help from Rome, which was in trouble itself. When the last Roman garrisons fled the isle of Britain, the secrets of sanitary design went with them.

Replacing them were the Barbarians, leveling cities and destroying populations as they hacked their way across the continent. Civilization reeled and regressed. Sanitation technology reverted to its basic form.

The early Christians rejected most anything Roman, including the value of cleanliness. They considered it unseemly to clean or to display material wealth. "All is vanity," stated an early Christian writer. St. Benedict pronounced that "to those that are well, and especially for the young, nothing shall either be permitted." A 4th-century pilgrim to Jerusalem would brag that she had not washed her face for eighteen years so as not to disturb the holy water used for baptism.

By the Middle Ages, the "hot houses" or stews of the Roman baths carried the stigma of debauchery and wildness. During the reign of Richard the Lion-hearted, the little rooms of "bendelloes" of the baths became synonymous with brothels.

In 1648 the first wave of Black Plague entered England through the town of Melcombe in Dorset County. One third of the population would be wiped out, as rats and fleas thrived in the filth and garbage swept up and about and all around.

"The Dark Ages had begun."

"The Recovery. The spigot of Agnew's Baths is demanding, backed under ruble and dirt, and unsanctioned for centuries before being restored to use. In the 16th century, the Great Bath, which measured 80' long, 40' wide and 6' deep, was still supplied water from the original conduit installed by the first Roman plumber in town."

In the 17th century it was the rage to drink copious glasses of water from Bath's pump room, located next door to the bathing rooms. According to one account, ladies of the blunderhead family allowed their servant girl, Tobitha Hunt, to bathe in the waters next door while they drank what they held. In those days servants bathed even less than their masters, who bathed hardly at all. Those were the days of perfume, powders and oil, not of soap and clean water. The following dialogue catches the tone of the age:

"You cannot conceive that a number of ladies were seated in the water, the same as in our parlour."

"So while little Toby was washing her turn, the ladies kept drinking it out of the pump."

It was not until the activities and public relations of the dandy Richard "Beau" Nash in the 18th century that bath was reclaimed its honor.

Nash was a celebrity of his day, a nobleman gambler who set the rules of behavior that proved fashionable for the era. The social whirl was comparable perhaps to the "jet set" or "jet setters" of our current age who seem to do nothing but get their pictures in magazines and help sell supermarket tabloids. The little town that had sprang up around the baths became the "last place of royalty and the upper class, non of a trellis "hanging" for Nash and his crowd. The Bath Address Book listed such dignitaries as..."

Far Right: Examples of ornate Victorian closets at the Gladstone museum.

Queen Anne and Thomas Gainsborough, and the showrooms of the great potter, Josiah Wedgwood.

In 1794, the future Admiral Lord Nelson spent some of his youth in Bath, and later paid occasional visits. After one visit to recuperate from battle wounds, he wrote: "My health, thank God, is very near perfectly restored, and I have very near the perfect use of my limbs, except my left arm."

The baths were back in business. When it happened, their reputation for healing had been embellished beyond even Roman legend. The waters would be touted as "good for obstructions, still more, age, dropsy, black and yellow jaundice, scirrhus kidneys or hard swelling of the spleen, scurvy, green sickness, whites in women, and defect and excess of their course."

Left: This original drawing shows the Gladstone pottery bottle kiln, typical of 19th century potteries including Tewyords, Royal Doulton and Wedgwood. All made plumbing fixtures at one time. Tewyords still does.
Plumbing & Mechanical, June 1953 • 57

Waste And Sewers. Where and how to dispose of waste and sewage have been the bane of Man since the beginnings of time. While sanitary engineers recognized the value of channeling waste to its own outlet, the problem of disposal became acute as populations proliferated and banded together.

Aristotle instructed his prize pupil, Alexander the Great, to make sure that dregs from animals, human waste, etc., was disposed of far from camp. Preaching his words by about 2,000 years is the Old Testament injunction that stated. Thou shalt have a place also without the camp, whither thou shalt go forth abroad, and thou shalt have a place upon thy westward, and it shall be within thy border; thou shalt dig therewith, and shall turn back and cover that which cometh from thee. (Deuteronomy 23)

But for a world truly, though odoriferous, to be a viable one, the Western world will have to again look to the ancient Romans.

The first sewers of Rome were built between 800 B.C. and 755 B.C., preceding the first aqueduct by about 300 years. Called the Cloaca Maxima, this sewer was one of the largest of the ancient sewers still in use. It was designed to carry off the surface water, and otherwise provide drainage for the entire city.

It was said that every street emptied into a channel of the sewer. However, only a few privileged patricians or noblemen had outlet to their houses. These were but extensions to their latrines located adjacent to their kitchens. As the untrapped ends of the sewer were the only sources of ventilation, the sewers had, noxious fumes expelled into the immediate area and wasted about. One wonders what the "smell" of "good cooking" really meant in those days.

By 14th century England, the problem was still unsolved. Cited from an old record, one reads that "the refuse from the king's kitchen had been run through the Great Hall in an open channel, to the serious injury to health and danger to life of those congregated at court."

Further complications resulted from medieval prisons or the capricious "gardechaises" (wardrobes) located in the "Great House" of castle. The chamber would be in a small vaulted room about 3' wide with a narrow window. The privy was built within the wall, with a vertical shaft below a stone for a wooden seat. The water would discharge into the mire below. If there were no water, the receptacle might be a barrel or a pit. In either case, it was a deadly chore to rake the offal. The job paid top wages for brave men needing to work. A crew of 15 men were paid three times the normal rate to clean the pit at Newgate Jail in 1281. It took them five nights. But the plight of one Richard the plumber. He fell through the planks of a public latrine and drowned in the deep pit of excrement below.

Underground channeling was a lapped arrangement as well. Drain tiles, connected from the "rouchest brickwork" or masonry, were 12" in cross-section, laid by laying flat stones to form the bottom of the drain. Then brick walls were built up and topped with flat stones. The tiles were built like shelter with no understanding of purpose. Some would be too big or too small, or running uphill or at right angles, etc.

The possibility of disease being transmitted through water and waste began to chip through centuries of ignorance. Scientific discoveries began to unfold. Some would even believe that an open compost heap was the probable cause of pestilence, sore throat and depressed health to many a cook, kitchen maid, and butler, and perhaps indirectly leads to our few parasites to the use of those noxious and self-prescribed medicines—spice and beer.

Stinkers: Flies, & Louse. The rivers of the Thames, Fleet and Wallbrook were open sewers, the Thames the most foul of all. The abominable odors of the Fleet, complained the nobility of the White Friars, were overcome the flue-some burnt; as the alarum; they claimed the fumes connect the depths of several brethren. Shepherds Lane, once a lively stream back in 1500, was to be more poetically known as Stilestone Lane. However, these were minor when compared to the state of the Thames.

No longer could a king's noble be caught whoring in the Thames River; as did the pitt of King Henry VIII. By the mid-1800s, the byproducts of the industrial...
[ROMAN & ENGLISH LEGACY]

Revolution were flowing, mixing, and founding with the water and sewage of nearly 3 million people in London. All sewer led to the Thames, pouring through buildings along the shores. For several subways in 1599, the Thames settled, seeped, and nearly boiled under the burning sun of an unusually hot season. Parliament was suspended—window blinds attained with lime and other disinfectants failed to subdue the odor and revolution. It was so revolting that an unknown newspaper editor even headed up to catch the columns of the day: “India is in Revolt,” and “The Thames Sinks.”

Personal hygiene barely existed under such a dilapidated sanitary system. Tenements swarmed with people, but there were no indoor “necessaries,” for them, not even running water.

Water was drawn from pumps situated in streets throughout the city, the water rationed and serving hundreds of people. The pumps were open only during certain hours of the morning and the water was carried home in pots or jugs, or just tasted in a pittance of a sip.

The finer homes may have had a tin or copper bathtub. But in the early 1800s, plumbing was still confined to the first floor, the water heated by kettles over an open fire.

Tenements looked several stories high as space was at a premium. The buildings were erected in long rows, back to back, containing tiny, no ventilation, with little or no sanitation (landlords were taxed for windows). Dirt and patent leftovers, if any, were on the ground floor.

Inside the house or apartment, waste was stored in a glass or metal chamber until filled. Tenants usually disposed of the contents by tossing them out the doors or windows.

Injuries caused by the fall of contents from the chamber pots, or “mistles of man,” as the ancient Greeks described, Railway stations, would call them, persisted through the ages. Early Roman law included the Defectivus Act, which stated it was a person who threw or poured anything else out of an open window and hit someone. The law awarded damages to the injured party. Significantly, the statute applied only during daytime hours.

The habits of people remained basically the same, and the problem continued well after the Romans left. England. King Richard II followed suit with his well of “Sanitato quod nod det durn,” “A well that does not lead to dampness.”

Proper manners would prescribe wearing shiny, patent-leather boots that a shower was on its way. Thus the cry of “Gardens Bait” (pronounced Garnets), and countless “Watch out for the water” (would echo up and down the streets. Over time, it evolved into English slang for the toilet, or loo.

The chamber pots of the working class were usually made of copper, although later ones might be of crockery. The chamber pots for the rich and royalty served the same function, and precautions were taken to keep the chamber pot clean and sanitary. James I had a portable “toilet,” which was used for traveling. All the chamber pots, of course, were carried and emptied by servants.

Feared about being poisoned, James I had one ensconced in a leather box and

[ROMAN & ENGLISH LEGACY]

locked shut with a key. Edward VI had a padded chamber pot, and the “elbow stool” of Henry VII was padded in black velvet, trimmed with ribbons, fringes, and quilting, all locked down with 2000 gilt nails. The Victoraus of the last century, the “wizards of gaudy,” invented a musical chamber pot that played when the hidden drawer in the table or commode was opened.

The Necessary: But for sheer invention, there is the tale of Sir John Harrington’s “Ajet” water closet, the first “necessary” ever built in English history. He built the toilet in 1565 for his godmother, Queen Elizabeth. It cannibalized the queen who took a bath once a month, “whether she needed it or not,” and installed it at her request in Richmond Palace. Although the Queen did use it, the toilet and Harrington were subject to ridicule and debate. Harrington never made another. It would be another 200 years before the idea took hold again.

The first patent for a “modern” toilet belongs to Alexander Cummings, who invented the “Toilet” in 1775. It had a sliding valve underneath to hold the water.

Three years later, Joseph Bramah, a Londoner and engineer, patented an improved version with two hinged valves. An original is still used in the House of Lords. The “Bramah” also became a prototype for closets installed in houses and ships.

The Good Life: In 1848, England passed the national Public Health Act, which would become a model plumbing code for the world to follow. It mandated some kind of sanitary arrangement in every house, whether a flushing toilet, or a privy, or an ash pit. The government also released 5 million British pounds for sanitary research and engineering, and began to build a sewer system.

Now there would be outlets for toilet system, their manufacture made sense.

With this new incentive for invention, pottery makers including Josiah Wedgwood, Thomas Twyford, and John Sharps began to turn to the inventors that they replaced have and metal and ceramic products were turned.

By 1858, George Jennings had popularized public sanitation. He had introduced the novelties by installing them in the Crystal Palace for the Great Exhibition of 1851, over 88,000 people paid to use the necessary conveniences.

By 1870, Thomas Twyford’s improved version of the Bramah contained no metal parts, and remained dry out of production. And, although Jennings’ potted seat toilet of 1854 won the Gold Medal at the Health Exhibition, it was Twyford who is credited with the revolutionary design of a one-piece toilet.

Before, a toilet was built in two parts; the top part a bowl, and the bottom half holding a separate pan. To keep the two together, the entire unit had to be controlled within a wood box. The box would leak at the joints and the smell would be terrible.

In 1855, Twyford pioneered the first unitary toilet and built the “Unitas” as a one-piece, free-standing unit on a platform base. This eliminated the problem of leaks and odor.

Tests for quality control were very basic. Jennings, whose toilet was judged “perfect and sanitary closet as can be made,” tested his unit by throwing in 10 apples 1-1/4" in size, one flat sponge and four pieces of paper. If the items cleared, the unit was pronounced fit.

John Sharps devised a different test for his units. He would throw a cup into the bowl and pull the chain. When the cup disappeared, he would cry out, “It works!”

Acceptance of water closets came slowly at first. But as closets became better made, and as proper connection eliminated disease, production grew. But there were still sporadic cases of typhoid in the second half of the 19th century.

One of the most notable cases affected the royal family. Queen Victoria’s husband, the popular Prince Albert, died of typhoid in 1861, as did her son, the future Edward VII, ten years later.

In 1871, the Prince of Wales lost his great, a friend, and almost his life to an outbreak of typhoid in Lousenborough Lodge, where he and his friends were staying. His groom died as well as his brother. The investigation proved contamination in the plumbing lines, and the problem was corrected and eliminated.

The profession of the 19th-century sanitary engineer had come almost fullcycle from the days of King Neros. In tribute, the Prince would be quoted as saying, “I could not be a prince, I would rather be a plumber.”
Chicago Science & Industry Museum exhibit of plumbers’ tools
By the 1880s, indoor plumbing was a prominent feature of better homes and row houses. That wasn’t necessarily good news, however.

Drainage was unsanitary, serving and unpinning unknown. House drains frequently would be buried under cement by house builders who didn’t know what to homeowners that dispelled their fears and instructed them how to ensure safe and healthy indoor plumbing.

Major urban centers like New York, Philadelphia and Boston enacted comprehensive codes to govern the sanitary arrangements of buildings. Governmental efforts to develop plumbing systems were propelled along by homeowners who began to seek advice on proper plumbing, repelled by the stench of sewer gas emanating from faulty drains and maintaining water service, gas service and drainage in a building.

The problems of the plumbing profession were not of its own making. Unlike today’s trade, the original plumbers were mechanics with virtually no knowledge of the health and sanitation implications of their work. Of course, how could anyone expect plumbers to know of those things when medical science was still debating the rise of microbes and sanitation was just coming into its own as

**THE GOOD OLD DAYS OF PLUMBING IN AMERICA**

*From Plumbing & Mechanical, July 1988*

All this newfound plumbing was all about. Soil pipe lines ended at the fixtures instead of extending to the roof and venting to atmosphere. Being wealthy enough to afford indoor plumbing during that era wasn’t as much of a status symbol as one might imagine. ‘To be sure, it added a certain dimension of convenience to life—most welcome, of course, on a frigid winter night. But the homes sold! And there were serious questions raised by people of high status whether their health might not be threatened by indoor plumbing. Most of their concerns were about sewer gas, which was widely believed to be the cause of disease. It would not be proven conclusively until 1900 that sewer gas was not the direct cause of health deterioration, but the misleading research served a useful purpose—sparking demand by homeowners for better, safer plumbing systems.

The true heyday of good, safe plumbing in America occurred from 1886 on. Much of the credit must go to the pioneering sanitation engineer George E. Warburton Jr. A landmark book of his published in 1876, *The Sanitary Drainage of Houses and Tenements*, sparked many municipal reforms in public health, building codes and sanitation systems. Warburton also wrote numerous other treatises and books and

Chicago Museum of Science and Industry exhibit.

In 1881, New York State led the nation in requiring the registration of plumbers, as well as board of Health supervision of all new plumbing installation. This was accomplished through prior submission and approval of plans and examinations of completed work.

In a research paper titled “The Plumbing Problem,” Columbia University’s Mary N. Stone observes that “an examination of water service, drainage and fixtures in New York City row houses built between 1880 and 1885 reveals that during this five-year period the plumbing arrangements changed from an unsafe to a fairly safe and sanitary one as a result of agitation and legislation.”

Growing Palms: The fits and starts of plumbing sanitation was mirrored by the growing pains of the plumbing industry as a whole, and most of all, the plumber.

Even then, the plumber’s reputation suffered because of the antics of unqualified jacksdaws. In the 1870s, the plumber was reviled, the term synonymous with “cheat,” according to May N. Stone. (The term “plumber” and “plumbing” were used only on a limited basis in the 18th century, reports Stone. “Bleachers and workers” and other synonyms were more common. The *Encyclopædia Britannica* did not include plumbing in its listings until 1911, at which time the trade was described as “work done for the purpose of fitting up an important engineering specialty.

Even in the mechanical end, early standards and regulations were poor to nonexistent, allowing virtually anyone to pass himself off as a plumber. A plumber’s license simply conferred upon him the right to open the street and make sewer connections; a small board having been given as an assurance that he would restore the pavement; no license whatever was required for work within a house,” writes Stone.

The plumber of yesterday also was befuddled by constant refinements in material, fixture design and piping arrangements, and requirements that changed from year to year. A house built in 1885 was passing master to current specifications might be condemned as faulty five years later.

Towards Professionalism: Sanitation knowledge inspired sanitation reform. Citizens at large demanded improvements in municipal water supply and sewage systems, and better plumbing systems in homes. And in more homes. Only a few more years would pass before American manufacturers would produce fixtures on a grand scale, equal to or better than their English prototypes.

It was time for the industry to get its act together. The need for education, cohesion, organization and standards gave rise to the formation of the plumbing industry’s three most important

*Plumbing & Mechanical, June 1993*
The card entitled the member to whom it was issued to all the benefits and privileges extended by the constitution and shall be recognized by all Local Unions of the United Association.

Local Union, No. 14
Of State of

This is to certify that the Bearer, Bro. Richard Smith is a Member in Good Standing for the Quarter Ending Dec. 1st 1929 - September, October, November.

[signature]

Announcing that still exists today: The National Association of Master Plumbers (now NAPCPC) in 1888; the Master Steam and Hot Water Fitters Association (now MHCA) in 1899; and the following year the United Association of Journeymen Plumbers, Gas Fitters, Steam Fitters and Steam Fiters' Helpers of the United States and Canada—the UA plumber's union. There were various reasons why all of these groups were formed, including economic advantage and to negotiate with labor relations. However, their most important legacy is training and education. The apprenticeship system was being organized, and an important philosophy injected into it, best expressed by master plumber James Tucker of Boston. As reported in A Heritage Unique, the official history of NAPCPC, Tucker delivered an essay titled "The Proper Education of the Plumber" at the 1884 convention, in which he argued: "No plumber can keep abreast of his trade if he educates his hand alone. The skilled hand is a good thing in its place, but without the educated eye...it will not permit the plumber to keep pace with the age. A knowledge of joint-wiping and trap and pipe-fixing is good so far as it goes, but it is not of much avail apart from a knowledge of sanitation in plumbing. The principles of hygiene, the subject of hydraulics, and so forth, are of the first importance. If you would be a sanitary plumber."

Expanding Role: The plumbing trade rapidly came up to snuff. A craftsmanship ethic took hold that created American plumbers to finally call themselves that with pride. It was plumbers, not engineers or product designers, who began writing and trapping fixtures. The new Irish and German immigrants became the backbone of the industry, bringing to America their work ethic and skills in the mechanical crafts. A well-trained plumber of the late 19th century learned his trade through apprenticeship or perhaps from serving as a plumber's helper. According to the Gasfitters' and Plumbers' Companion, an early trade publication, he usually owned his own tools. Included in his carpentry would be a soldering iron, ladders, cloth, pliers, hook, turn plumb, chipping knife, dressers, hammer, wrench, wrench, plane, and several minor tools.

Union plumbers in St. Paul could expect to earn $5.90 a day for "first-class men" and $2.50 for "second-class men", reported the first edition of the United Association Journal of October 1, 1902. A standard work day was eight hours, so figure a union wage at roughly 44¢ an hour.

With winter setting in and recession taking hold, reports of work varied around the country and Canada. Bad news from Toronto was that two-thirds of UA plumbers were unemployed, and the weekly hours were cut. Those who were lucky enough to get jobs worked "only" eight hours a day, "only" till noon on Saturday. This made "only" a 44-hour week.

Times were had in Milwaukee, too, but plumbers were hopeful that new
buildings would be going up soon.

Minneapolis Local No. 785 was working eight hours, "the wages are good, although no scale has been adopted as yet," report the Journal. Peoria Columbus, work was also "dull," but there was great spot. The state Board of Health promised strong support for a law governing plumbing and inspection. There will still be no "practical" men as inspectors.

The LA Journal shows a balance of $420,000 in funds as of Sept. 1, 1892, and counted 1,600 members on the LA locals. The 96 locals were spread out over 30 states and two provinces of Canada. It wasn't bad for a fledgling association organized a few short years before.

Ten years later, in 1902, a successful strike in Terre Haute, Indiana, resulted in an increase in wages of 50c an hour. From $3.85 for a day's work, 80c an hour, the union plumbers now could expect to receive $5.60 per hour, or $4.25 for an eight-hour day.

Spreading friction made news, too. The Journal printed an item stating that while wages had increased 4.5% during 1890-1899, the cost of living had jumped ahead at the rate of 6%.

Grangerism Gripps the Journal printed letters from various locals. They were nite with reports of locoists and skilled, and citations of "industrial spies." "Spies"? Plumbing was advancing, but labor relations were still nite in the Dark Ages.

Iowa complained about politics and union organizing. "Practical plumbers" complained one disgruntled IAM member. And what's worse, they were subjected to the municipal ring. "Principles" were not being enforced and sanitary conditions resulted.

And Brother Doyle wrote from St. Paul, "The worst evil we have to contend with is the indiscriminate selection of apprentices... without regard to their fitness. A large number comes from the high-pressure element in the city... well versed in the slang of the street, but their education has been sadly neglected in other respects.

"After working a year or two," Doyle goes on, "the employer urges him to "sweep a dock" is what the boy calls it, and he will get a dollar or two added to his wages in the week and a lot of things." This apprentice then quits the employer after awhile, and is given the tools, including that double-section adjustable tool called the helper, "If he's smart, get jobbing and an innocent public suffers for his ignorance."

A Plumber's Life: A fascinating glimpse of the life of a plumber that once was portrayed in a family document donated to the archives of the United Association by John Kremer of Three Rivers, Michigan, and Bob Matheson of Rochester, Minnesota. Bob is a great-grandson of Ernest H. Maus Sr., who lived around the turn of the century and founded Maus Plumbing and Heating Co. in Rochester. The company still continues under family ownership, Bob Matheson Jr., is its president.

Eight years old when he came to America, Ernest Maus Sr., already had a full-time job in a tailor's shop when he was 12. Then he picked up work in a printing mill and later a sawmill at the princely daily wage of $1.50, all of which he dutifully turned over to his father.

"In those days, most of the children did not get the education they get nowadays. Work Week. That was the idea and I always did work," wrote Ernest Maus Sr. in a note that betrays both lament and pride.

Work was more plentiful in Rochester than in his hometown of Winona, Minnesota, and he moved there in 1884 to work in a hardware store. There were other reasons why I wanted to stay in Rochester," he confided, "for I had made the acquaintance of some nice girls and so I more than my mind to stay." A three-year contract stipulated he would be paid $2 per week the first year, $3 the second, and a royal amount of $6 per week in the third year. "I had to pay $5 a week for board, so now figure that out," he wrote.

Maus moonlighted in making stovepipe at "four cents per piece," and earned another $1 a night for four extra hours of work. In that hard work, good reputation in stovepipe work, and a broken leg, he came to the attention of Dr. W. W. Mayo, and then Mayo's two sons, Will and Charles, the soon-to-be famous Mayo brothers, who established the Mayo Clinic.

The brothers tapped Maus to install the plumbing, tin work and cosmetics in the hospital building, all two floors and 15 rooms. The water closets emptied into a big cistern until the public works system came on line a few years later.

There were two bathrooms, one on each floor of the clinic's original building. The bathroom had a common but sink with two faucets, "which had to be opened by hand," Maus noted.

"Dr. Will wanted to find out whether there was not some way by which he could operate the faucets with his feet," said Maus of the famous surgeon. A good workman must be innovative and willing to try new methods, so we had a pair of pebbles made by a blacksmith, put some self-forting stops in the pipes under the sink, and attached them to the pedals. "Oh, Boy, that was something," he reminisced. "Just a wood floor in the operating room and yet that was the start." Expert fiddlers that he was, Maus also made lead screws for the new X-ray equipment.

From workman to entrepreneur, Maus staved at opportunity again. With a partner, he took over a plumbing and steamfitting shop in Rochester and really set to task. They rented a building at $17 a month, and bought a two-wheeled cart. A horse was added, then two horses and a wagon. They incorporated in 1910 as Maus Plumbing and Heating Company.

Product Explosion: There is a fate de etere to the writings of Ernest Maus.

Below: Shown open, a folding hipped awning, with silver plated faucet and couplings. It cost $21.

Bottom: The Plumbers Catalogue offered a water closet encased either in mahogany ($30), black or French walnut ($40), or plain black walnut ($30).
The complete cast-iron kitchen sink was offered in sizes from 30" to 48" x 23" x 9", and cost from $15.50 to $24 (plugs) to $33.54 (enameled).

When one reveals himself to be a delightful man and a credit to his craft, He clearly was proved at having been a plumbing innovator.

Crawford himself must have been happy with change. New technology and lack of uniform standards and requirements became the norm for many workers. The scope of range of new plumbing products could be intimidating.

Average citizens also had to adjust to changing habits and mores. Augmented by the rapid advances in plumbing technology and the low cost of goods produced on a mass scale, Americans were soon registering the highest standards in health and hygiene. But old ways are sometimes slow and unwilling to change.

Plated pipes of shiny brass tubing became the vogue, open plumbing quite the fashion. It was a sign of progress to show off the myriad pipes and bends of plumbing schemes. Some were the cabinet choosers and dry-sink furniture. Freestanding fixtures became popular, and sometimes highly ornamented. Associated with sanitation and cleanliness, white became the chosen color.

As American manufacturers caught up with the Europeans, their plumbing products began to sweep the market. Indoor plumbing became a commonplace commodity, especially in the northeastern and Middle Atlantic states, which were close to the emerging American manufacturers and plumbing supply houses.

Horn Applique: The hand pump all but disappeared as fixtures joined forces with the kitchen sink. Separate faucets for hot and cold appeared, usually of nickel-plated iron. For the more affluent were brass or copper faucets, the niches in gold- or silver-plating. To avoid confusion in using the water, the words "FROST" and "COLD" were written on the handles or maybe set on porcelain buttons at the top of the faucet. At first, the spouts were fixed in place, but by the turn of the century, they swung around to right or left angles. Early models featured the legs, gooseneck spouts which have become so popular again.

The pedestal-base sink became the sure-footed fixture in the bathroom. An ingenious touch was the soap receptacle and/or towel bar incorporated into the design. Off the assembly line came sinks in all types of materials. Kitchen sinks were made from cast iron or copper and sometimes brass. Nickel-plated or chrome casings were the most common. But they weren't too dainty—the coating was off. Porcelain china, ceramic bowls and marble appeared in the bathroom then, soon to be replaced by vitreous china.

When they first came out, sinks were freestanding. They rested on cast-iron legs often painted white to match the chrome or porcelain. The legs imitated the period furniture, with bail or claw feet.

In the 1890s, the bathtub was widely denounced as an "episcopal English innovation which would surely corrupt the democratic simplicity of the Republic." By the 1900s, the Saturday night bath was an American institution.

Prior to the 1890s, bathtubs were copper-lined wooden boxes, the metal requiring constant polishing. Then cast-iron tubs took hold, first appearing in institutions. They weren't too popular in private homes, however—the enameled linings tended to scale off. Porcelain was the choice material.

No Burns Allowed: A symbol of the times, and best plumbing lay in construction of George Washington Vanderbilt's Vanderbilt house in Asheville, North Carolina. "Bun" contractors need not apply, the work order states.

Built in 1895, it featured 52 bathrooms, box water, flush toilets, tubs and showers, the whole works. It's estimated that the estate cost the equivalent of well over $50 million in today's dollars to construct.

Vanderbilt ordered most of the fixtures and fittings from England—their plumbing products still being rated the best in style and quality. The closets featured copper-lined oak tanks. They were mounted approximately 8½ feet above the bowl, operated by a key with a tag or a pull chain. The closets were all stowed to the roof, and all water lines had drums.

Vanderbilt's personal bathroom featured a huge, round tub. Not lacking for any amenities, it also contained a handshower.

Vanderbilt had no qualms about using American-made pipe; the quality was always first-rate. Unfortunately, there was no standardization—each pipe and fixture manufacturer had his own specifications. Neither in American nor metric measure was there any uniformity, not even in sink and basin outlets, faucet drilling, trap gages, and so on.

To repair any brass pipe thread or valve nipping, for example, the fitter had to match exactly the thread size by using hand-operated dies. It was a bane of muscle and precision to cut off 9½ pipe.

Attitudes Die Hard: The Vanderbilt mansion offers an intriguing view through the history of American plumbing, but one that is very much off the beaten path today in the standard sizes.

The big story, and true glory, of the American plumbing industry, is its having brought sanitation and hygiene to the masses. It was not until after World War II that the majority of the American people had private baths in their homes. But long before private bathrooms became common, the working class had access to cleanliness in the form of public bathhouses.

Chicago's first free public bath house opened with great fanfare in January 1890. Free soap and a towel were handed out to each bather, who was allowed 20 minutes. It was a great success. Like Roman spas of old, the bath house had a steam room and a pool. Birch ovens heated the room to 250°, the customers lathering each other up with soap, warming water, using thick brushes of dried oak leaves. Patrons then doused themselves with cold water, took a shower and received a rubdown from the masseur.

But not everyone was happy. When another bathhouse was being built a couple of miles away, neighborhood citizens complained. But they allowed construction to proceed only after being assured that the presence of the bath house in their midst didn't mean they would be forced to take baths!
The first epidemic of a waterborne disease probably was caused by an infected cowman relieving himself in waters upstream of his neighbors. Perhaps the entire clan was decimated, or maybe the panicked runners guided up their gourd and fled from the "evil spirits" inhabiting their camp to some other place.

As long as people lived in small groups isolated from each other, such incidents were sporadic. But as civilization progressed, people began clustering into cities. They shared communal water; handled unwashed food, stepped in excrement from casual discharge or spread it merrily; used urine for dyes, bleaches, and even as an antiseptic. As cities became crowded, they also became the breeding places of waterborne, insect borne, and animal borne infectious diseases that spurred out unchecked and seemingly at will. Typhus was most common, reported Thomas Sydenham, England's first great physician, who lived in the 17th century and studied early history. Next came typhoid and relapsing fever, plague and other pestilential fever, smallpox and dysentery—the latter a generic class of disease that includes what's known as dysentery, as well as cholera.

The ancients had no insight as to the true cause of their misery. People believed divine retribution caused plagues and epidemics—or else bad air, or contagion of the planets and stars, any and all of these things.

Ignorance Ain't Bliss! How else to explain healthy people suddenly falling dead within hours and soldiers stricken down with no signs of wounds? What else would cause such excruciating deaths, accompanied by delirium or hallucination, the body reeking by yellow or green or black vomit or excreted, or covered with obscene black bile, terrible red spots or ghastly blue pallor? Why else would such sickness remain for months, then leave suddenly and not reappear till years later? Or perhaps it was replaced by a plague more deadly.

Hippocrates, the "Father of Medicine" who lived around 580 B.C., recommended boiling water to filter out impurities—those particles that pollute its sweet taste, mar its clarity or poison the palate.

He was onto something, but his advice pertained only to what the observer could taste, touch, smell or see with the naked eye. The "what you see is what you get" approach was not about the extent of scientific water analysis until the late 1900s.

That invisible organisms also thrive and swim around in a watery environment was beyond imagination until a few centuries ago, and their connection with disease wasn't established till it went 100 years ago. Although the microscope was invented in 1674, it took 200 years more for scientists to discover its use in isolating and identifying specific microbes of particular disease. Only then could public health campaigns and sanitary standards join forces in eradicating ancient and

This 14th Century woodcut depicts the sorrow of medieval people as they begin burying their dead.
The Romans built huge aqueducts conveying millions of gallons of water daily, magnificent public baths and remarkable sewer systems—some of which, the Cloaca Maxima, is still in use. (Some spread the plumbing technology throughout many of its far-flung territories as well.

Yet, while we might rightfully marvel at the Roman legacy in plumbing, it should be noted that they were motivated primarily by concerns of comfort, convenience. They understood very well that bringing fresh water to the mansions and disposing of waste made for a more pleasant way of life, but there is little evidence they understood the connection with disease control.

Bursting Rome's Bubble: In fact, the magnificence of the great city-state diminished quite a bit when its plumbing systems came under close scrutiny. Scum grew up haphazard fashion, a town of crooked, narrow streets and squatted houses. In its heyday, Rome had a population of over one million, and waste disposal was a definite problem.

They got water supply of Rome was obtained from ground water and rain water. And in many cases these mixed together. The lowlands of the countryside were swampland which developed into marshes. The Romans developed underground channels to drain the natural swamps and secure water for irrigation and drinking. Nevertheless, a particular region known as the Pontine Marshes were all but indistinguishable during the summertime until drained during the reign of Caesar Mucianus (some 46,000 Romans died in a 16th century malaria epidemic.)

A luxury toilet in the private houses of the well-to-do was a small, oblong hole in the floor, without a seat—similar to toilts that prevail in the Far East and other sections of the world even today. A vertical drain connected the toilet to a cesspool below.

The great Roman spas accommodated hundreds and even thousands of bathers at a time. But without filtration or circulation systems, the baths hosted in germs-ridden water and the huge pools had to be emptied and refilled daily.

In public latrines, a continuous bucket of salt water stood close by in which rested a long stick with a sponge tied to one end. The user would dip the person with the sponge end and return the stick to the water for the next one to use. The stick later evolved into the shaper of a hockey stick, and the source for the expression "getting hold of the wrong end of the stick." It also provided an excellent medium for passing along bacteria and the asserted diseases they engendered.

Running water for the latrine either was supplied by stone water tanks or else by an aqueduct patterned after the graceful.
Above: The casual supply of water in barrels and buckets was easy prey to a waterborne bacteria.

Right: The agony of entire families besieged with a dreaded disease, and the benevolence of some neighbors in aid.

Far right: Riots frequently broke out as friends and relatives rallied against the forced isolation of new arrivals by ship or steamboat.

...occurred... made famous by the Roman engineers. These water experts knew that covering water keeps it cool from the sun and helps prevent the spread of algae. In perfect though their plumbing knowledge may have been, the Roman Empire still did an admirable job among public cleanliness and, inadvertently, health. Rome employed administrators known as 'quaestors' to oversee various public works including cisterns, aqueducts and the police. They also were in charge of seeing that streets were swept of garbage and streams were kept free of pollution and debris.

...Decline & Fall: Through the Roman Empire would rise until the 6th century A.D., its fall was preceded by centuries of gradual decay, conflict and unrest. Ironically, some historians suggest that the Roman "plumber" (quaestor) may have played a significant role in the downfall due to their extensive use of lead. So prized was the craftsmanship of these "quaestors" that in lieu of present-day Vatican symbols like a Roofs...
of the central fire. The floor was strewn with hax or rushes, easy havens for lice and vermin. Garbage accumulated within.

If they were lucky, the family had a chamber pot, though more likely they relieved themselves in the corner of the hovel or in the snow and much outside. Water was too precious to use for anything except drinking and cooking, so people rarely bathed. Hell, they barely changed clothes from one season to another, wearing the same set every day, perhaps piling on more rags for warmth.

MARIAN HOSPITAL

source of lead contamination. The widespread use of lead cooking vessels and dividing toilets probably was more harmful than it was in plumbing.

Whatever the causes, over time there was a noticeable deterioration in the moral values, dignity and physical character of Roman society. Symbolic of this general decline, by the time of Augustus Caesar in A.D. 14, the once-authoritative caligae collected the waste not only at state-sponsored events.

During the final century of Roman domination, there was a succession of earthquakes, volcanic eruptions and disease epidemics. Soon afterwards, marauding Vandals and other barbaric tribes completed the breakdown of Western civilization, as they systematically looted and defiled the great Roman cities and their water systems.

Then came a thousand years of medieval squatter. A thousand years of filth and disease. A thousand years of unbridled violence, fueled by lust and megalomania. Excrement and filth, stagnant and contaminated water of every description.

Age Of Diseases. The typical peasant family of the eighteenth century lived in a one-room, dirt-floor hovel, with a hole in the thatched roof to let out the smoke.

These are the conditions which spread the infamous Black Plague, killing an estimated third of the European population. Although not directly related to bad plumbing, the plague serves as the most striking example of misery caused by poor sanitation in general, and the ignorance of people in controlling the outbreaks.

The first of several waves hit England in 1348, caused by flea bites spread by insects that dwelled on hoot black rats. They, in turn, fed on the garbage and excrement of the mice. London became largely deserted. The King and Queen and other rich people fled to the countryside.

The poor were the greatest sufferers. Panic, death and despair followed the abandonment of farms and towns. Wrote William of Dere, a monk of Rochester in Kent, England, "Men and women buried their own children on their shoulders to the church and threw them into a common pit. From these pits such an appalling stench was given off that scarcely anyone dared to walk beside the cemeteries, so roused a deficiency of labors and workmen that more than a third of the land in the whole realm was left to lay.

So bad was the "Black Death," the Great Fire of London in 1666 can be viewed as a blessing in disguise. Though it killed thousands of people, the holocaust also consumed garbage, much and black rats, effectively ending the plague.

Crop Killers. Bad plumbing was merely one of many sanitation factors that gave rise to the Black Death. Other ills were more directly related to human waste. Dysentery is one that has left an indelible mark on history.

Characterized by painful diarrhea, dysentery is often called an "army's fifth column." Identified as far back as the time of Hippocrates and before, it comes in various forms of infectious disorders and is said to have contributed to the defeat of the Crusaders. Wrote the eminent English historian, Charles Coxeon: "The Crusaders of the 11th-13th centuries were not so much destroyed by the scimitars of the Saracens as by the hostile bacteria of dysentery and other epidemics."

The summer of the first Crusade in 1099 was extraordinarily hot, as the ill-prepared and poorly armed "army" of men and camp followers went to war with little more than the clothes on their backs—evident that the Lord would provide for their needs in such a holy cause. They demurred the land of trees and bushes in the quest for refreshment. Harmed by lack of fresh water and contaminated containers, they trudged along to their destiny, relieving themselves along the way or in the flesh.

Dysentery hit the women and children first, and then the troops. More than 100,000 died. Plus about 2,500 German reinforcements whose bodies remained unburied.

Typhus fever is another disease from bad sanitation. It has come under many headings, including "ail fever" or "ship fever," because it is so common among men in poor, crowded surroundings. Transmitted by lice that dwell in human faces, it is highly contagious.

Napoleon lost thousands of his men to typhus in Russia, and so did the Russians who caught it from the enemy. Many historians believe that Napoleon would have won were it not for the might of his opponents "General Winter, General Famine, and General Typhus."

French ships were notorious for their filthy and feverridden sailors. One such French squadron left its soiled clothing and blankets behind near Halifax, Nova Scotia, when they returned to Europe in 1756, thinking they could destroy their own plague. Their infected blankets wiped out a nation of Indians.

Typhoid fever, a slightly different...
[Plagues & Epidemics]

Slightly more contaful than typhus, involves a Salmonella bacillus that is found in the feces and urine of man. The symptoms are so similar to typhus that the two were not differentiated until 1837.

Prince Albert died from typhoid in 1861. His wife, Queen Victoria, had built immunity because of a previous bout. Good thing, because she is said to have prevented herself in grief across the dead body of her beloved husband.

Ten years later, Victoria’s son, Edward, always died from the disease. A plumber traced the contamination to the lines of a newly-installed water closet and fixed the problem. Edward, the Prince of Wales, was very grateful to the plumber. Word spread of this episode and is thought to have hastened the acceptance of the indoor water closet in England.

By the time of the Boer War in 1899-1901, antityphoid inoculation was available. By then, typhoid fever was recognized as a waterborne disease, and that the germ could be killed by filtering and boiling water. For the people of South Africa, the unscrupulous British troops succumbed to the hot climate and drank straight from the rivers. Out of 400,000 troops, 43,000 contracted typhoid.

Closer to home, typhoid raged on in colonial New York and Massachusetts. It reappeared for the last time in epidemic form in America in the early 1900s, compliments of the celebrated Typhoid Mary.

Mary Mallon was a cook for the wealthy set of New York State; her specialty was homemade ice cream. Officially, she infected 55 people—with three deaths—before she was tracked down. Unofficially, she is blamed for some 1,500 cases that occurred in 1905 in Miasca, where she worked for several families. Never seek herself, it took a lot of persuasion by authorities to convince her that she was a carrier of the disease. Health authorities quarantined her once, let her go, then quarantined her for the rest of her life when another outbreak occurred.

The Cholera Story: The good news is that another intractable disease, cholera, has proven to be one of history’s most violent letters. The good news is that it was through cholera epidemics that epidemiologists finally discovered the link between sanitation and public health, which provided the impetus for modern water and sewage systems.

With 20th-century smog, we know cholera is caused by ingesting water, food, or any other material contaminated by the feces of a cholera victim. Close contact with a contaminated chamberpot, soiled clothing or bedding, etc., might be all that is required.

The disease is stunning in its rapidity. The onset of extreme diarrhea, sharp muscular cramps, vomiting and fever, and then death—all can transpire within 12-48 hours.

In the 19th century cholera became the world’s first truly global disease in a series of epidemics that proved to be a watershed for the history of epidemiology. Fostering along the Ganges River in India for centuries, the disease broke out in Calcutta in 1817 with global-scale results.

India’s traditional, great Kumbh festival at Hardwar in the Upper Ganges triggered the outbreak. The festival lasts three months, drawing pilgrims from all over the country. Those from
the Lower Bengal brought the disease with them as they shared the polluted water of the Ganges and the open, crowded camps on its banks. When the festival was over, they carried cholera back to their homes in other parts of India.

There is no reliable evidence of how many Indians perished during that epidemic, but the British army counted 10,000 fatalities among its imperial troops. Based on those numbers, it's almost certain that at least hundreds of thousands of natives must have fallen victim across that vast land.

When the festival ended, cholera raged along the trade routes to Iran, Baba and Astrakhan and up the Volga into Russia, where merchants gathered for the great autumn fair in Nijni Novgorod. When the merchants went back to their homes in inner Russia and Europe, the disease went along with them.

Cholera spread from port to port, the germs making headway in contaminated lugs of water or in the excrement of infected victims and transmitted by travelers. The world was getting smaller thanks to steam-powered trains and ships, but living conditions were slow to improve. By 1852 cholera had become the most feared disease of the century.

The Laughter Died: It struck so suddenly a man could be in good health at daybreak and be buried at midnight. A New Yorker in 1854 described himself pitching forward to the street "as if knocked down with an ax." I had no premonitions at all.

The ailment seemed capable of penetrating any quarantine of harbor or city. It chose its victims capriciously, with terrifying suddenness, and with groans and grotesque results. Acute dehydration turns victims into whimpering caricatures of their former selves. The skin becomes black and blue, the hands and feet drawn and puckered. The German poet Heinrich Heine described an outbreak in Paris in a letter to a friend:

"A masked ball in progress... suddenly the gayest of the participants collapsed, cold in the face, and underneath his mask blue in the face. Laughter died out. Dancing ceased and in a short while cartridge-bags of people hurried from the dance to the Hotel Dieu in dieu, and to prevent a panic among the prisoners were thrust into rude graves in their dormitories (long, brooked cases worn with a half mask). Soon the public halls were filled with dead bodies, sewed in sacks for want of coffins...long lines of hearse stood in queues..."

The worldwide cholera epidemic was aided by the Industrial Revolution and the accompanying growth of urban tenements and slums. There was little or no provision at all for cesspools or fresh water supplies. Tenements rose several stories high, but cesspools were only on the ground floor with no clear access to sewers or indoor running water. It didn't make much difference, because until the 1860s a sewer was no more than an elongated cesspool with an overflow at one end. "Night men" had to climb into the manholes and shovel the filth and mire out by hand. In most cases, buckets filled with excrement were discharged outside, or contents of chamber pots flung from open windows— if there were any— to the streets below.

Water hydrants or street pumps provided the only source of water, but they opened infrequently and not always as scheduled. They ran only a few minutes a day in some of the poor districts. A near riot ensued in Westminster one Sunday when a water pipe (not supplied) 16 packed houses was turned on for only five minutes that week.

Cholera first hit England through the town of Sunderland, on October 25, 1851. One William Spurri died that day from the disease, though nobody wanted to admit it. Merchants and officials found plenty of reasons to rationalize away a prospective 40-day maritime quarantine of the ports.

England was reaping the profits of the Industrial Revolution, and a quarantine of ships would be catastrophic for the textile industry. At any rate, the medical profession held that cholera wasn't contagious. Public health administration was in its infancy, and so disorganized that the leading doctor didn't know there were two infected houses only a short distance away from each other. He learned of the "coincidence" three months later.

The American Experience: American hygienic and sanitary conditions were not much better. Cholera spread through immigrants from the infected countries, Ireland in particular, whose masses were fleeing the poverty and despair of the potato famine. To those who could scrimp together three pounds for passage left for North America.

Life aboard an immigrant ship was appalling as ship owners crowded 500 passengers in space intended for 150. Infected passengers shared slop buckets and rainwater.

The contagion spread as soon as the immigrants landed. In one month, 1,220 new arrivals were dead in Montreal. Another 2,200 died in Quebec over the summer of 1852.

Detroit became another focal point of the cholera. Instead of drawing fresh water from the Detroit River, people used well water. The land was low and it was much more contaminated. But outhouses placed at old locations soon contaminated those wells, and cholera spread quickly.

Cholera entered New York through infected ships. City officials wanted shoring the roads in an effort to cleanse the land. On June 19, 1852, the governor ordered a day of fasting and prayers—the traditional response by government to treating the disease. After July 4, there was a daily cholera report.

Quarantine regulations which sought to contain towns and
cities in upper New York, Vermont, and along the Erie Canal, met with little success. Immigrants leaped from halted canal boats and passed through locks on foot, despite the efforts by contingents of armed militia to stop them. Some doctors flatly declared that cholera was indeed epidemic in New York, but more people sided with banker John Peterman that the "offensive report" was an "important interference" with the Board of Health. The banker incredulously asked if the physicians had any idea what such an announcement would do to the city's business.

Visitors were struck by the silence of New York's streets, with their uncustomed cleanliness and strewn with chloride of lime (the usual remedy for foul-smelling garbage). Even on Broadway, passersby were few. What a man on horseback was a curiosity. One young woman recalled seeing tars of grass growing in the little used thoroughfares.

Big news was unfolding in England then, but no one realized the significance.

**Breadth Ignorance** The eminent Dr. John Snow demonstrated how cases of cholera that broke out in a district of central London could all be traced to a single source of contaminated drinking water. Sixteen years later, Snow would win a $30,000 prize from the Institute of France for his theory that cholera was waterborne and taken into the system by mouth. But Snow's original work received little attention from the medical profession. He was attacked at the weakest point—that he could not identify the nature of the "poison" in the water.

By the end of the first cholera epidemic, the relationship between disease and dirty, polluted parts of town was rather well established. They should have spurred sanitary reform. But little action followed.

An out-of-sight, out-of-mind syndrome developed when the first epidemic cooled. The famed Edinburgh Medical and Surgical Journal at one point declared they would review no more books on the subject "because of the multitude of books which have recently issued from the press on the subject of cholera, and our determination to no longer try the patience of our readers."

When the second cholera epidemic hit England in 1854, Snow described it as "the most terrible outbreak of cholera which ever occurred in this kingdom." At least it provided him with an opportunity to test his theory.

By charting the incidence of the disease, he showed that over 500 cases occurred within 10 days over a radius of some 250 yards centered on London's Broad Street. He looked for some poison which he believed came from the excreta of cholera patients and swirled by the new victims. A common factor was the use of water that had been polluted with sewage. Snow had traced the pipelines of various water companies and showed that one was infected by cholera.

By the methodical process of elimination, he proved his point: A waterworks in that area had its own private well, and there were only 5 deaths among its 855 inmates. A brewery on Broad Street likewise never used the water from the Broad Street pump, and it had no cases among its 70 workers.

The actual discovery of the comma-shaped bacillus of cholera was made by the German Dr. Robert Koch in 1876. Through microscopic examination, he ascertained that "excrement may contain cholera bacilli a good while after the actual attack of the disease."

**Final Obstacles** Cholera was always the worst where poor drainage and human contact came together. This of course applied to in crowded ships.

So at first, those on top of the social heap could reassure themselves that cholera attacked only the filthy, the hungry and the ignorant. When the cholera epidemic first hit Paris, there were so few deaths outside of the lower classes, that the poor regarded the cholera epidemic as a poison plot hatched by the aristocracy and executed by the doctors. In Milwaukee, efforts to apply basic health measures were thwarted by rapacious and "small children" who saw the removal of filth and garbage from the streets as a threat to their livelihood. As one newspaper editorialized, "It is a great pity if our stomachs must suffer to save the noise of the rich."

The immunity enjoyed by the wealthy was short-lived, however. The open sewers of the poor sections eventually leached into the ground and seeped into wells, or ran along channels into the rivers that supplied drinking water for whole towns and cities. Once the rich and the movers and shakers of society began to get sick, government reform began.

Thus it happened that most municipal water mains and sewer systems got built in the late 19th century in America. Public health agencies got formed and funded. Building codes and ordinances got passed and enforced.

The superstitions of the ages had finally run their course. Mankind began to understand that the evil spirits causing its woes were microscopic creatures that could be defeated by plagues and sanitary engineers.

Plumbers finally got to show their stuff in a way that had not been seen since the days of the Roman Empire.
An 18th Century advertisement for “Emptying Bog Houses”
Early 19th century cartoons commenting on the dangerous state of the River Thames, a source of London’s drinking water

(London under London, page 89)
Ever in the first century BC, the dangers of lead poisoning, or plumblum, were already known to the Romans. Vitruvius, the engineer and author of the classic De architecture, wrote at this time that lead should not be used for water supply pipes, but his advice seems to have gone unheeded. Almost 2,000 years later, it was still in common use in Britain for this purpose, and it is estimated that today nine million homes are still supplied through lead pipes.

Between the fifth century AD, when the Roman Empire fell, and the nineteenth century, there were virtually no significant technical developments in the history of plumbing. What finally brought about the changes when they did come was the pollution of water supplies that grew worse as rapid industrialisation and urbanisation swept Britain and other European countries. Epidemics, caused by waterborne organisms, were frequent during the Middle Ages. Later, during the seventeenth and eighteenth centuries, new distribution systems were introduced in London and Paris mostly using cast iron pipes. It was not until the nineteenth century, though, that effective filtration methods were employed. At first this was by the slow-sand method; later still, by the use of chemicals to sterilise the water using chlorine compounds.

Public health measures sought to eradicate the widespread outbreaks of typhoid, cholera and other infections caused through primitive water supply and drainage systems. As they began to be effective, life expectancy rose dramatically. By the middle of the nineteenth century, Manchester had introduced the first municipal water supply. By 1863 London had spent £4 million on an 83-mile long sewerage system and other measures stemming from various health acts.
THOMAS CRAPPER: MYTH AND REALITY

The debate over who Thomas Crapper was—or even if there was a Thomas Crapper at all—continues. His contributions to the plumbing industry are even more suspect. But with this article we intend to replace myth with fact, for we have found a cadre of Thomas Crapper scholars who have made it their life's work to prove that Crapper is more than just a slang term brought home by the World War I Doughboys.

For this article we interviewed Dr. Andy Gibbons, historian of the International Thomas Crapper Society, and John Grabowski, a researcher and author who is writing a book on Crapper's life.

**Myth:** Thomas Crapper as a person never existed.

**Fact:** Though we do not know his actual date of birth, we can now say with some certainty that Thomas Crapper was born in September 1856. Since he was baptized 28th of that month, he must have been baptized 28th of that month.

Crapper did have a successful career in the plumbing industry in England from 1861 to 1909. The date of Crapper's death has also been a source of confusion for many years. For example, Crapper's Annual Events, the authoritative book for listing special days and dates, has listed January 17 as Thomas Crapper Day and January 17, 1910 as the date of his death.

**LEFT:** A Thomas Crapper advertisement picked up at a souvenir stand in Stoke-On-Trent, England.

**RIGHT:** Another example of Crapper memorabilia from a souvenir store.

After all his research, Gibbons was certain that Crapper's death was January 27, 1910. The error probably resulted from an honest typo in "Huston With Pride," by Wallace Reayburn, who writes Gibbons, "but I waved a blue flag with Crapper's to get them to change the date." He finally won his battle this year after supplying them with a photo of Thomas Crapper's mundane cisterns from a living descendant, and a copy of the man's official death certificate.

**Myth:** Thomas Crapper invented the toilet.

**Fact:** No one is the inventor of the toilet. Thomas Crapper is credited with inventing the "Silent Valveless Water Waste Preventer" (No. 814) was a syphon discharge system that allowed a toilet to flush effectively when the cistern was only half full. British Patent 4990 for 1899 was issued to a Mr. Albert Gibbons for this product.

There are a couple of theories on how Thomas Crapper came to be associated with this device. First, is that Gibbons worked for Crapper as an employee and authorized his use of the device. The second, and more likely scenario, says Grabowski, is that Crapper bought the patent rights from Gibbons and marketed the device himself.

**Myth:** Thomas Crapper never was a plumber.

**Fact:** Oh, yes he was. He operated two of the first Crapper plumbing shops in his lifetime, but left the business three years before the final and most famous facility on Kings Road in London. When Crapper retired from active business in 1904, he sold his shop to two partners who, with help from others, operated the company under the Crapper name until its closing in 1966.

**Below:** This sign is for sale at a lighting shop in London. The asking price of this gem was around $280.
Possible site of part of Thomas Crapper's works in the 600 block of Kings Road.

Several of London's current plumbing companies trace their trade roots to Thomas Crapper. One, Mr. Geoffrey Pidgorn of Original Bathrooms (Richmond upon Thames, Surrey, Great Britain), continues the trade of his great uncle and grandfather, both of whom apprenticed under Thomas Crapper.

Thomas Crapper did serve as the royal sanitary engineer for many members of England's royalty, but contrary to popular myth, he was never knighted, and thus isn't entitled to use the term "Sir" before his name.

Myth: The word "crapper" is derived from Thomas Crapper's name.

Fact: The origin of crap is still being debated. Possible sources include the Dutch Kraper, Low German kraper, meaning a vile and inedible fish; Middle English crappe, and Thomas Crapper. Where crap is derived from Crapper, it is by a process known as, pardon the pun, a back formation.

The World War I doughboys passing through England brought together Crapper's name and the toilet. They saw the words T. Crapper — Chelsea printed on the tanks and coined the slang "crapper" meaning toilet.

The legend of Thomas Crapper takes its flavor from the real man's life. While Crapper may not be the inventor of the product he is most often associated with, his contribution to England's plumbing history is significant. And the man's legend, well, it lives on despite all proof to the contrary.

Obviously fraudulent advertising is often complete with "Crapper's royal appointment." One should also note that stainless steel was not manufactured until the 20th century.
IMPROVED

LAVATORY BASIN.

White Ware, fitted with combined Overflow and Waste, and 1/2 Standard Screw-down Valves... 2 19 0
Plated Fittings, Extra ... ... ... ... 0 8 6

ELASTIC VALVE CLOSET.

No. 78.—Valve Closet, with white china dish with gold lines, and handle, white ware flushing rim basin, 1 in. supply valve, copper air regulator, complete as shown.

If with 3/4 in. valve ... ... ... Extra 0 3 6
  Ornamental Basin ... ... ... 0 3 6
  White and Gold Basin ... ... ... 0 8 9
  Box Enamelled inside ... ... ... 0 4 9
  Box fitted with Brass Top ... ... 0 6 3
  Box fitted with union to connect Ventilating Pipe ... ... ... 0 3 9
  4 in. outlet ... ... ... ... 0 7 9

IMPROVED SYPHON

Water Waste Preventer.

Cast-Iron 2 Gallon Syphon Waste Preventer, with Tranquil Inlet Valve, and Silencing Air Tubes, and Brass Chain and China Pull ... ... ... 1 1 6
Ditto, 3 gallon ditto ... ... ... ... ... 1 3 6

50, 52, & 54, MARLBOROUGH ROAD, CHELSEA, LONDON, S.W.
THOMAS CRAPPER
THROUGH A SCHOLAR’S EYES

Which came first, the word “crap” or the name of the legendary inventor of the Valveless Water-Waste Preventer? Yes, for the third straight year PM reports another raging debate over the very existence of Thomas Crapper. He is forever (it seems) regaled in the annals of plumbing lore as a great sanitary engineer and master plumber of the royal water closets of England.

Into the heart of controversy has plunged Dr. Robert H. Bell, professor of English at Williams College. Appearing in the March-April edition of the learned Harvard Review, Bell’s essay “In Quest of Crapper” seeks to divine the origins of the word “crap.” It first appeared in a Supplement to the Oxford English Dictionary as a synonym for “excrement, defecation.” Bell was a little bemused that Crapper would have been nine years old when the word “crap” officially came into recorded use in 1846 — that is, if one takes seriously the birth date given in Wallace Reyburn’s 90-page tome, Flushed With Pride: The Story of Thomas Crapper, published in 1969.

Admittedly skeptical, Dr. Bell first thought Reyburn’s book was an elaborate hoax. Then he picked up a Newsweek which reviewed the book. The magazine concluded that

By Carol Pomerantz

London “Crapabilia” includes the sign at left offered by a lighting shop for around $200, and a souvenir stand’s version of a Thomas Crapper advertisement.

THOMAS CRAPPER & CO.’S
Patent Waterfall No. 1

THOS CRAPPERS

Improved Lavatory Basin.

Improved Cistern. Water Closet Retainer.

18, 60, 62, 68, MANHATTAN ROAD, BROOKLYN, N.Y.

Reprinted from Plumbing & Mechanical, July 1988

(Plumbing & Mechanical magazine, July 1988)
the "man not only lived but made a lasting contribution to mankind's comfort."

His curiosity really piqued. Bell dug further. He checked encyclopedias but couldn't find a bit of Crapper in them. Nor did the London Times report his supposed death in 1910.

Yet he did find an entry in The People's Almanac under "The History of the Toilet." Crapper, he read, is "a myth created by Wallace Reyburn, and noted that many prestigious people and learning institutions have fallen for Reyburn's spoof as historical fact."

Digging yet deeper, Bell uncovered a London Times article dated Nov. 27, 1929 about the Greater London Council's desire to honor Crapper with a blue plaque to commemorate his former home. But "The Committee decided that 'memorable though Crapper's name might be in popular terms,' evidence from the Patents Office showed that he was not a notable inventor or pioneer in his field."

Bell was disturbed, and had discussions with esteemed colleagues about the merits of Crapper. He wrote to the Library of Congress and asked them to check the London post office directories of the 1850s. He listened carefully to the chairman of the history department firmly espousing his belief that of course there was an English Crapper — why the name's name was inscribed on a venerable Victorian Crapper in his friend's loo. However, whether the toilet bore the inventor's name or simply referred to "a Crapper" as slang wasn't made clear.

Bell next contacted an eminent scholar whose assistant porched over London's Register of Deaths. Ah, no record there of the unnamed Crapper, but at least 5% of names are not recorded, it was explained. And the reference in David Piper's The Companion Guide to London to Crapper's address? It comes with the explanation that one can find "Mr. Thomas Crapper's renowned establishment (Sanitary engineer to King George V)" — but Crapper supposedly died the year young George became king.

Then the Library of Congress scored one for Crapper's side. It had tracked down The Post Office London Directory for 1897, which lists Crapper's address on page 525 as "numbers 50, 52, and 54 Marlboro Road: Crapper, Thomas and Co., sanitary engineers." Plus it threw in elaboration of patent numbers for toilet devices, dated and in the name of Thomas Crapper.

What About Reyburn? Really ex-
Thomas Crapper (1835–1910)

Thomas Crapper was born in Thorne, near Doncaster, Yorkshire. As a young boy, he appears to have decided that his future lay in London, and aged only eleven walked to the capital where he found employment with a plumber in Chelsea. In 1861 he established his own business in Robert Street, and in 1866 moved to Marlborough Road where he established a manufactory including a brass works.

In spite of his fame, Crapper actually had very little to do with the development of the water closet. No major stages in its development are attributable to him, although he took out a patent for a self-rising closet seat in 1853 and another in 1902 for a trough closet fitted with water-sealed traps under each unit. His biographer, Wallace Reyburn, has emphasised his role in developing water waste preventing cisterns, but he was not responsible for any major improvements in these either. By the time he took out a patent for automatic flushing cisterns in 1891, ‘pull and let go’ syphonic cisterns were already well established. He also patented a disconnecting trap for drains, a seat-action automatic flush, and, in 1902, an improved type of stair tread.

Thomas Crapper’s place in the history of sanitary equipment, therefore, is not that of a pioneer, but rather as a representative of the many Victorian sanitary ware manufacturers who profited from efforts to improve standards of public health and domestic sanitation from the 1840s. Like many sanitary engineers, Crapper’s technical skills were based in metal working – in his case, plumbing and brass founding – and not potting. Crapper produced a wide range of sanitary fittings including domestic ware – such as the attractive ceramic pedestal closets, the ‘Marlboro’ introduced in 1887 – and drain components. Cast-iron man-holes bearing his name are widely found; there are three in Westminster Abbey. In 1886 he was granted a royal warrant after installing new sanitary fittings at Sandringham House, the home of the Prince of Wales.

In 1907 the firm moved to 120 Kings Road, Chelsea and Thomas sold the business to his old partner, Robert Warham and his nephew, George Crapper. He was remembered as a genial man of average height with a grey beard similar to that of George V. He died in 1910 and is buried in Elmers End Cemetery, south-east London. The firm continued to trade independently until 1966 when it was taken over by John Boding and Co., who went bankrupt in 1969. Crapper and Co. was sold to another firm and lay dormant until acquired by Simon Kirby in 1999. Now back in business as Ainscot Park, Stratford-on-Avon, Thomas Crapper and Co.’s range includes a water closet, the ‘Venerable’, cast-iron cisterns and lavatory basins based on items produced by the company in the late nineteenth century.

Bazalgette’s map of London’s main interceptory sewer system, started 1859, finished 1865
(London under London-A Subterranean Guide, Richard Trench & Ellis Hillman,
John Murray 1984, page 72)
Work on the northern outfall sewer running across Plaistow and East Ham Marshes to Beckton, started 1861 (London page 74)

Construction of the Crossness sewage treatment works at Crossness, at the confluence of the Thames and Barking Creek (London page 73)
Abbey Mills pumping station in Venetian Gothic style (London page 74)

Becton under construction 1865 (London page 76)
The tunnels at Wick Lane near Old Ford (London page 77)

The Crossness Works at Becton (London page 79)
Common Materials used in Water Supply Systems

LEAD, TERRACOTTA AND BRONZE were already in use by the time of the Romans’ great engineering feats. These are the most common materials used in water supply systems down the ages.

- **Roman:** Ducts of stone; open ducts of masonry; fittings of bronze; pipes of stone, terracotta, wood, leather and lead.

- **France, seventeenth century:** Cast iron pipes were used to supply Versailles; they were joined by bolted flanges.

- **London, seventeenth and eighteenth centuries:** The New River Company (see Chronology) used bored elm logs with spigot-and-socket joints, the smaller tapered end being coated with white lead and driven into the larger end that was reinforced with a larger band. In 1745 the London Bridge Waterworks Company laid more than 49,000 m of wooden pipe; 3,500 m of lead and only 1,650 m of cast iron. Thomas Simpson designed the first bell-and-spigot and lead joints in 1785.

- **United States, mid-nineteenth century onwards:** Wooden pipes banded with iron, steel or bronze spiralled around it; pipe plastics; later cast iron. In 1848 Dr Robert Angus Smith, an Englishman, patented an effective exterior coating against corrosion, combining asphalt, pitch, lined oil, and resin. Wrought iron and steel, especially for larger diameters and lengths, became more common into the twentieth century, not least due to its lightness and ease of handling.

- **United States and Spain, twentieth century:** Reinforced concrete became popular for larger diameter mains.

- **Large pipes** have also been made in cement-asbestos (from 1915), lead, copper, fibrous compounds and plastics.
“Work” painted by Ford Madox Brown 1863
Labourers working on the sewers in Hampstead