



*The Roman baths in Bath date from 50 AD  
(Plumbing & Mechanical magazine, USA, June 1993)*

**T**estaments to the ancient plumber echo in the ruins of rudimentary drains, grandiose palaces and bath houses, and in vast aqueducts and lesser water systems of empires long buried. Close to 4,000 years ago, about 1700 B.C., the Minoan Palace of Knossos on the isle of Crete featured four separate drainage systems that emptied

earthenware, 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 fits 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

magnificence... walls covered with mosaics; perpetual streams of hot water poured into capacious basins through so many wide mouths of bright and massy silver."

Miles from the source of supply, water flowed through a series of aqueducts, streaming by gravity along the contours of land. The longest overhead 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

## THE HISTORY OF PLUMBING— OUR ROMAN & ENGLISH LEGACY

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into great sewers constructed of stone.

Terra cotta pipe was laid beneath the palace floor, hidden from view. Each section was about 2 1/2' long, slightly tapered at one end, and nearly 1" in diameter. It provided water for fountains and faucets of marble, gold and silver that jetted hot and cold running water.

Harbored in the palace latrine was the world's first flushing "water closet" or toilet, with a wooden seat and a small reservoir of water. The device, however, was lost for thousands of years amid the rubble of flood and decay. Not until the 16th Century would **Sir John Harington** invent a "washout" closet anew, similar in principle. And it would take still another 200 years before another Englishman, **Alexander Cumming**, would patent the forerunner of the toilet used today. The luminous names of **Doulton**, **Wedgwood**, **Shanks**, and **Twyford** would follow.

But it's to the plumbing engineers of the Old Roman Empire that the Western world owes its allegiance. The glory of the Roman legions lay not only in the roads they built and the system of law and order they provided. It was their engineering genius and the skill of their craftsmen that enabled them to erect great baths and recreation centers, the water supplied by aqueducts from sources miles away.

**Plumbing Defined:** While early pipe and conduit was made from wood or

essence, everything involving supply and waste. In fact, this general job description of plumbers' work lasted into the 20th century.

Hot and cold water systems were already developed by the Greeks, but to the stalwart, individualistic Spartan, it was unmanly to use hot water. His idea of the bath tub was a polished marble bowl about 30" in height. He would stand in the tub, and have a slave douse him with water over his head and his body. The sole purpose was a quick, functional, cold rinse—the colder, the quicker! Thus Grecian bath houses never developed hot water systems as extensively as the Romans.

Roman society, on the other hand, fostered a communal spirit, and barracks comradery for its troops. The public baths were the city centers of group enjoyment, places of gossip and contacts. To prolong their pleasure and relaxation, they developed hot water and steam systems that evolved to service colossal structures. Some would say that the Roman bath houses by early A.D. would pale only next to those of King Minos.

The baths of the Emperor Caracalla, for example, covered nearly a 28-acre site. It contained more than 1,600 marble seats, and still fell short of the baths of Diocletian, which seated over 3,000. "Stupendous aqueducts," reported Gibbons in the *Decline and Fall of the Roman Empire*, "replenished the Thermae, or baths, constructed with Imperial

development, aqueducts carried about 300 gallons of water for every citizen.

At first, the Roman baths opened only during the daylight hours, which allowed for the emptying and refilling of the water at least once a day. This helped matters somewhat, in that hundreds would use the same pools of stagnant, germ-ridden, unfiltered, fetid water. The dawn of scientific discovery would not be for hundreds more years. Even the best and brightest of the ancient Romans knew nothing about bacteria and the true causes of disease.

The bath complex housed a succession of baths, with many entrances for easy access. Surrounding the complex on at least three sides were houses and shops.

Warm air for the Thermae bath was supplied by furnaces heating hollow bricks located under the entire floor. As the name suggests, the Frigidarium was the cold water bath; it fed the hot water tanks and other baths. The Tepidarium contained baths of moderate heat, and the Caldarium the hottest.

There was also a separate steam bath, and a small circular chamber covered by a high dome. An opening in the center of the dome provided light; it also vented the chamber. As a rudimentary way of regulating the heat, the vent could be raised or lowered.

One could take a hot bath in a tub or a plunge into cold water, but the tub was soon supplanted by a larger unit.

The bath measured 10-12 ft. in diameter, and was about 3 ft. deep. One

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

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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 fabled excesses, it was Nero's pleasure to bathe, gorge himself with food and fancy, bathe, etc., in his great catered 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 prevented the water from running over.

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

By the 4th century A.D., Rome would have 11 public baths, 1,352 public fountains and cisterns, and 856 private baths. In Pompeii, some homes had 30 taps.

As mentioned, the water supply was provided by aqueducts, the first one built in 312 B.C. Named in honor of its originator, Appius 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 gladiator fashion, i.e., until one was killed in combat, or spared by the emperor.

**The English Connection:** At the height of its power the Roman Empire had conquered most of Europe, including about 1,600 sq. mi. of Britain, its farthest outpost. And in the ruins of Aquae Sulis, the famed spas of Bath, lay the vestige of the rise and fall, and redevelopment of plumbing technique.

By the time the Romans reached Britain in 43 A.D., the curative powers of the hot baths were already part of English legend. Back in 863 B.C., the waters had supposedly healed the leprosy of its Celtic discoverer, Prince Bladud (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 that available sources of building stone and lead were close by.

Following Roman custom, Claudius developed Aquae Sulis in the image of the great baths back home, but scaled in size to its smaller location. At that, the complex must have comprised approximately 23 acres.

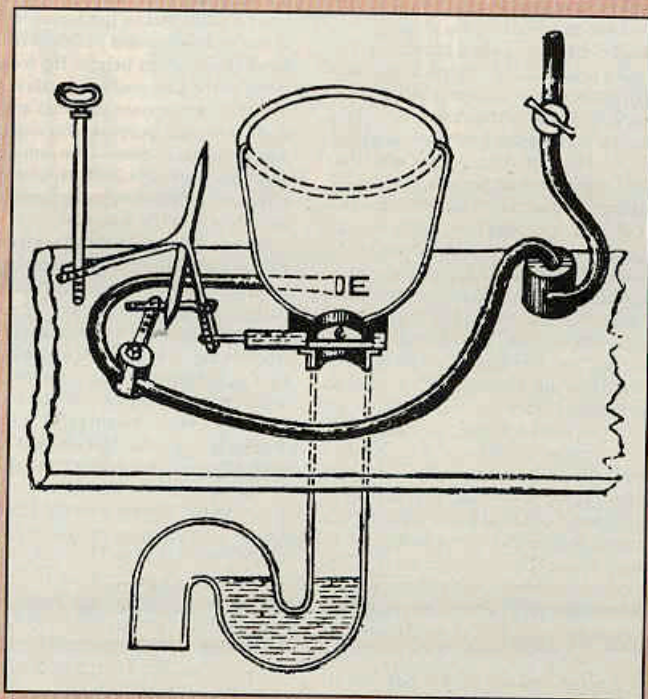
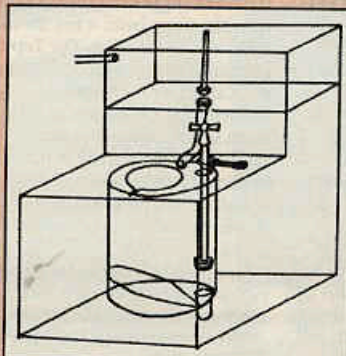
One monumental hall led into another as the floor plan radiated to various heated rooms, steam rooms, baths and swimming pools, plus a gymnasium and social rooms for eating and drinking. A playfield was attached to the complex as well.

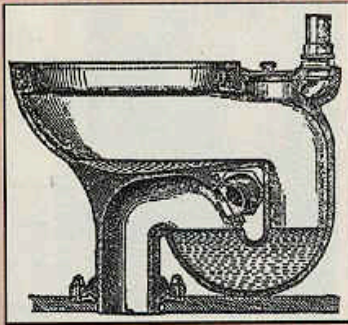
The small, circular pool was probably built for women and children, who at first used the pool only at stated hours and separate from the men. But eventually regulations broke down and both sexes intermingled throughout the pleasure complex.

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

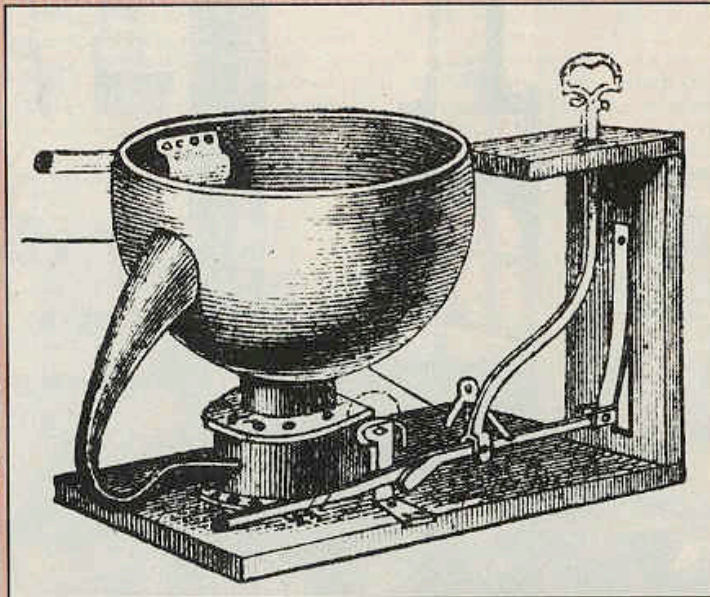
*Right: The first notable toilet design was by the "father of the modern water closet," Alexander Cumming. He announced his patent in 1775. The bowl held water by means of a sliding valve underneath. The lever operating the valve admitted water from the cistern. Cumming's "soil pipe" was really an S-trap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

*Below: In 1595 Sir John Harington installed this closet in his home. It was called the "Ajax"—a pun for "a jakes," common words for a toilet back then.*





Above: An example of a late Victorian washout closet. This closet had a shallow basin with a dished tray and a water seal. The flush water drove the contents into the main body of this tray, into the main body of the pan, and through the S-trap. J.G. Jennings, a sanitary pioneer, patented such a closet in 1852. Famed potter Thomas Twyford was a leading promoter of this design during the 1870's.



Right: In 1778, Joseph Bramah patented a closet which had two hinged valves. The first valve introduced water from a cistern; the second water for the bowl eliminating odors from the soil pipe, drains or cesspool. Pottery manufacturers thought it used too much brass, and would be unprofitable as china.

Empire, whose ruination became complete by the sixth century A.D. By then Roman garrisons in Britain had been invaded by hordes 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 decimating populations as they hacked their way across the continent. Civilization reeled and regressed. Sanitation technology reverted to its basest forms.

The early Christians rejected most anything Roman, including the value of cleanliness. They considered it unsaintly to be clean, sinful 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, bathing shall seldom be permitted." A 4th-century pilgrim to Jerusalem would brag that she had not washed her face for 18 years so as "not to disturb the holy water" used at her baptism.

By the Middle Ages, the "hot houses" or "stews" of the Roman baths carried the stigma of debauchery and wild parties. During the reign of Richard the Lionhearted, the little rooms or

"bordellos" of the baths became synonymous with brothels.

In 1348 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 steeped in and about and all around.

The Dark Ages had begun.

**The Recovery:** The spas of Aquae Sulis lay dormant, buried under rubble and dirt, and unappreciated for centuries before being restored to use. In the 16th century, the Cross Bath was "worthilie called the hot bath, for at the first coming, men thinke that it would scale their flesh, and lose it from the bone, but after a season... more tolerable and easier to be borne."

Cartloads of wood or coal provided the fuel for the warm-air furnaces, especially for the hottest room with its sub-floor heating. The Great Bath, which measured 80' long x 40' wide and 6' deep, was still supplied water from the original conduit installed by the first Roman plumber in town.

In the 18th century it was the rage to drink copious glasses of water from Bath's pump room, located next door to the bathing room. According to one account, ladies of the Blunderhead family allowed their servant girl, Tabitha Runt,

to bathe in the waters next door while they drank their water at the pump. 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 doggerel catches the tone of the age:

*You cannot conceive that  
a number of ladies  
Were washed in the water  
the same as our maid.  
So while little Tabby  
was washing her rump,  
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 reclaimed its luster.

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 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 sprung up around the baths became the "in" place of royalty and the upper class, sort of a trendy "hangout" for Nash and his crowd. The Bath Address Book listed such dignitaries as



Above: Scene from the Sanitary Ceramics Gallery of the Gladstone Pottery Museum, Longton, Stoke-On-Trent, England. Fixtures date from 1850-1870.

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



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

In 1780-81, 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; ague, dropsy, black and yellow jaundice, schirrus binis or hard swelling of the spleen, scurvy, greensickness, whites in women, and defect and excess of their course."

Left: This original drawing shows the Gladstone pottery bottle kilns, typical of 19th century potteries including Twyfords, Royal Doulton and Wedgwood. All made plumbing fixtures at one time. Twyfords still does.



**Waste And Sewers:** Where and how to dispose of waste and sewage have been the bane of Man since the beginnings of time.

While early on he recognized the value of camping downstream to let "running water take its course," the problem of disposal became acute as populations proliferated and banded together.

Aristotle instructed his prize pupil, Alexander the Great, to make sure that dung from animals, human waste, etc., was disposed of far from camp. Predating his words by about 3,000 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 paddle upon thy weapon; and it shall be when thou shalt ease thyself abroad, thou shalt dig wherewith, and shall turn back and cover that which cometh from thee.* (Deuteronomy 23)

But for a workable, though odoriferous, plan on a grand scale, the Western world will have to again look to the ancient Romans.

The first sewers of Rome were built between 800 B.C. and 735 B.C., preceding the first aqueduct by about 500 years. Called the Cloaca Maxima, this sewer is 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 outlets to their houses. These were but extensions to their latrines located adjacent to their kitchens. As the untrapped ends of the

Raker. He fell through the planks of a public latrine and drowned in the deep pit of excrement below.

Underground channeling was a haphazard arrangement as well. Drain tiles, constructed from the "roughest brickwork" or masonry, were 12" in cross section, made by laying flat stones to form the bottom of the drain. Then brick walls



sewer were the only sources of ventilation that the sewers had, noxious fumes expelled into the immediate area and wafted about. One wonders what the "smell" of "good cooking" really meant in those days.

By 14th century England, the problem was still unsolved. Culled from an old record, one reads that "the refuse from the king's kitchen had long 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 privies or the euphemistic "garderober" (wardrobes for undressing) located in the "Great House" or 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 waste would discharge into the moat 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 but desperate men needing to work. A crew of 13 men were paid three times the normal rate to clean the pit at Newgate Jail in 1281. It took them five nights.

But pity the plight of one Richard the

were built up, and topped with flat stones.

The drains were built helter-skelter 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 cesspool was "the probable cause of headache, sore throat and depressed health to many a cook, kitchen maid and butler, and perhaps indirectly leads, in not a few instances, to the use of those treacherous self-prescribed medicines—spirits and beer."

**Stinks, Pots, & Loos:** The rivers of the Thames, Fleet and Walbrook were open sewers, the Thames the most foul of all. The abominable odors of the Fleet, complained the monks of the White Friars, have overcome the frankincense burnt at the altar"; they claimed the fumes caused the deaths of several brethren. Sherborne Lane, once a lovely stream back in 1300, was to be more popularly known as Shiteburn Lane. However, these were minor when compared to the state of the Thames.

No longer could a king's polar bear catch salmon in the Thomas River, as did the pet of King Henry VIII. By the mid-1800s, the by-products of the Industrial

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Revolution were flowering, mixing, and foaming with the waste and stench of nearly 3 million people in London. All sewers led to the Thames, pouring through bulkheads along the shores.

For several sultry days in 1859, the Thames seethed, seeped, and nearly boiled under the burning sun of an unusually hot season. Parliament was suspended as window blinds saturated with lime chloride and other disinfectants failed to subdue the odor and revulsion.

It was so revolting that one foreign newspaper bannered twin headlines to catch the calamities of the day: "India Is In Revolt, and The Thames Stinks."

Personal hygiene fared no better under such a dead-end sanitary system. Tenements swarmed with people, but there were no indoor "necessaries" for them, not even running water.

Water was drawn from pumps stationed in streets throughout the city, the water rationed and serving hundreds of people. The pumps were open only during certain hours of certain days, the water to be 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 bath tub. But in the early 1800s piping was still confined to the first floor, the water heated by kettles over an open fire.

Tenements loomed several stories high as space was at a premium. The buildings were erected in long rows, back to back, containing tiny-room apartments with little or no ventilation (landlords were taxed for windows). Dank and putrid latrines, if any, were on the ground floor.

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

Injuries caused by the far-flung contents of the chamber pots, or "missiles of mirth," as the ancient Greek dramatist, Aeschylus, would call them, persisted through the ages. Early Roman law included the Dejecti Effusive Act, which fined a person who threw or poured anything out of an open window and hit someone. The law awarded damages to the injured party. Strangely, 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 writ of *Statuto quo nul fecit dung*, "A writ that no one is to dump dung." This earliest of health laws was finally repealed in 1856.

Proper manners would prescribe warning unwary pedestrians that a shower was on its way. Thus the cry of "Gardez l'eau" (pronounced *Gardy-loo*, and meaning "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 were solid silver, the kings' ornate and pretentious. James I had a portable "potty," which he used for traveling. All the chamber pots, of course, were carried and emptied by servants.

Paranoid about being poisoned, James I had one encased in a leather box and

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locked shut with a key. Edward VI had a padded chamber pot, and the "close stool" of Henry VIII was padded in black velvet, trimmed with ribbons, fringes, and quilting, all tacked on with 2,000 gilt nails. The Victorians of the last century, the "wizards of gadgetry," invented a musical chamber pot that played when the hidden drawer in the table or commode was opened.

**The Necessaries:** But for sheer invention, there is the relic of **Sir John Harington's** "Ajax" water closet, the first "necessary" ever built in English history. He built the toilet in 1596 for his godmother, Queen Elizabeth I (immortalized as the queen who took a bath once a month "whether she need it or no"), and installed it for her use in Richmond Palace. Although the Queen did use it, the toilet and Harington were subject to ridicule and derision. Harington 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 Cumming, who invented the "S" trap in 1775. It had a sliding valve underneath to hold the water. Three years later, **Joseph Bramah**, a locksmith 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 on boats 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 sound sewer system. Now that there would be outlets for toilet systems, their manufacture made sense.

With this new incentive for invention, pottery makers including Josiah Wedgwood, Thomas Twyford, and John Shanks began to team with the inventors as they replaced brass and metal workings of Bramah's invention with all ceramic parts.

By 1858, **George Jennings** had popularized public lavatories. He had introduced the novelties by installing them in the Crystal Palace for the Great Exhibition of 1851; over 827,000 people paid to use the "necessary convenience."

By 1870, Thomas Twyford's improved version of the Bramah contained no metal parts, and Bramah fell out of production. And, although Jennings' pedestal vase toilet of 1884 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 contained within a wood box. The box would leak at the joints, and the smell would be terrible.

In 1885, Twyford pioneered the first trapless toilet and built the "Unitas" as a one-piece, free-standing unit on a pedestal base. This eliminated the problem of leaky

joints and foul odor.

Tests for quality control were very basic: Jennings, whose toilet was judged "as perfect a 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 Shanks** devised a different test for his units. He would throw a cap into the bowl and pull the chain. When the cap 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, had died of typhoid in 1861, as almost did her son, the future Edward VII, ten years later.

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

The craftsmanship of the 19th-century sanitary engineer had come almost full-cycle from the days of King Minos. In tribute, the Prince would be quoted as saying, "If I could not be a prince, I would rather be a plumber." **PM**