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All the modern conveniences: American household plumbing, 1840–1870

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Iowa State University, 1992

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All the modern conveniences:
American household plumbing, 1840-1870

by

Maureen Ogle

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Getting beneath the surface of an historically obsolete technology and into an understanding of the way people used it is always difficult: often the object itself—its nuts and bolts, levers and cranks—no longer exists, at least not in the form in which people originally used it. Without physical evidence, historians have a hard time determining exactly how well or how poorly an object worked, what the relationship was of one part to another and the whole to some other object, and most importantly, what use people actually made of the object day in and day out. Mid-nineteenth century American plumbing fixtures are a case in point. The objects themselves, mundane then and humor-provoking now, are almost nonexistent: as people abandoned wells and cisterns in favor of late century municipal water systems, and replaced pan and hopper closets with washdown and syphon toilets, the tangible record of the old technology largely disappeared. And because plumbing is the stuff of which the mundane is made, no archive exists to preserve its memory; no one captured on film the remains of a rapidly disappearing era of household sanitation, the way they might think to capture a battlefield, inaugural ceremony, or famous politician. Magazines, trade catalogs, and architectural sketch books can provide much information about water fixtures' form and use, but even if a water closet or sink used in 1850 looked somewhat like one used in 1900, that resemblance was limited to form only. In both form and function, as
well as in its legal and cultural setting, mid-century plumbing differed markedly from that used at century's end.

Little scholarly or historical attention has been paid to this ubiquitous American technology. Typically historians have been most interested in late nineteenth and early twentieth century plumbing, reasoning that the historically significant moment in plumbing history occurred when most American cities had municipal water and sewer systems, and when low-cost porcelain fixtures and the modern flush toilet appeared on the scene. Their reasons for defining that particular moment, which occurred in the 1880s and 1890s, as primary are twofold. First, historians have assumed that the use of plumbing requires an external system of sewer and water conduits, and so plumbing could become widespread only after most cities had built the appropriate infrastructure. Second, some historians believe plumbing's real history began when all the people, not just the wealthy, could afford to use it, a moment that occurred when low-cost porcelain fixtures and the flush toilet appeared. At that point American plumbing assumed its "modern" form which, for all intents and purposes, has remained unchanged; thus, those seeking the "roots" of modern plumbing find it at the tail end of the nineteenth century.

But looking at plumbing only at that moment, when it became "democratized," as Daniel Boorstin has described it, means missing out on about fifty years of American plumbing history and making it difficult if not impossible to understand how earlier plumbing differed from later. For example, late-nineteenth century Americans regarded plumbing as a necessity for both comfort and health. But the tens of thousands of mid-nineteenth century Americans who used plumbing did not
share that attitude, nor did they expect to find plumbing in every home. Indeed, the very fact, as some historians have pointed out, that mid-century Americans connected its use to "class," rather than to concerns about private and public health and sanitation, provides a tantalizing historical puzzle. Moreover, as suggested above, beginning in the 1870s the American attitude toward plumbing underwent a profound transformation that had significant consequences. This new attitude prompted the universal adoption of plumbing and in a form that more or less resembles what is still being used today. Americans came to see "sanitary ware" as a household necessity for good health and hygiene; this attitude created a consumer demand, from which followed the appearance of low cost fixtures and installation in homes of every income level. But it seems reasonable to ponder the plumbing and plumbing use that preceded that moment of transition. If people adopted a new attitude toward plumbing in the 1870s, what was the old one? More importantly, how had the earlier attitude shaped both the technology and people's use of it, and what does that view say about American society at the time? Put another way, what has been treated as the important starting point for plumbing history, the late nineteenth century, is regarded here as the aftermath of a thirty year period during which a large and diverse group of Americans began to experiment with plumbing as part of domestic life. This study examines only briefly the moment of transition, and instead focuses on household plumbing used between 1840 and 1870, the decades during which many Americans introduced all the modern conveniences into their homes for the first time.

See especially Strasser, Never Done, 86; Stone, "Plumbing Paradox," 285; Cowan, More Work for Mother, 87, 173.

Boorstin, The Democratic Experience, 353.


The 1840s and 1850s marked a period of great excitement in the United States. Immigrants flooded the nation's harbors, migrants poured across the plains to the far west, the issue of slavery commanded national attention, reform movements competed for adherents, and cities grew apace. These events had such far-reaching historical consequences, that it is easy to overlook other ripples in the nation's social and cultural fabric. The antebellum decades also marked a period of change in American domestic life, which in turn prompted the appearance of plumbing in the American home.

**Plumbing in Mid-Nineteenth Century America**

Prior to about 1840 Americans showed little interest in installing permanent plumbing fixtures and piped water in their homes, and the many builders' manuals published during the first forty years of the century rarely included information for plumbers or about plumbing.¹ There is even some evidence that people approached water-based technologies with trepidation.² Until the 1840s the federal government issued few plumbing-related patents, which suggests that Americans had little interest in either modifying or improving upon the kinds of fixtures already available; people interested in experimenting with water fixtures apparently used common cisterns and hand pumps, portable washbasins and tubs, and the many mechanical water closets patented in Great
Britain or Europe in the late eighteenth and early nineteenth centuries. Of course some wealthy households boasted piped water, permanent bathing tubs, and water closets. By the early 1830s, for example, the White House had water closets, shower baths of some sort, and piped spring water in the kitchen area. But those cases seem to have been rare, and few people owned private baths and showers attached to running water. Early nineteenth century Philadelphians, for instance, who had access to the nation's best water works, seldom used their piped water to supply plumbing fixtures; according to one source, the first household tub with plumbing appeared in that city almost twenty-five years after the water works opened. Instead, the most conspicuous and copious displays of plumbing technology appeared in hotels, rather than private homes.

Beginning in the 1840s, however, Americans began to express a definite and widespread interest in this technology as discussions of plumbing and plumbing fixtures began to appear in magazines and books, and running water and water fixtures entered the private home. One indicator of change is that virtually all of the many mid-century architectural "style" or plan books, which also made their first appearance in the early 1840s, included discussions of plumbing. The books' authors compiled house plans and elevations and wrote lengthy essays on architectural principles in an effort to provide Americans with the knowledge necessary to create quality homes. Style books offered the reader guidance in choosing the appropriate dwelling style, size, and internal arrangement for his or her needs, and made suggestions on architectural aesthetics. But many of these manuals also contained discussions, albeit of varying length and detail, on how to
install and use water fixtures. They also included numerous house plans with plumbing, and described the plumbing fixtures and installations found in houses that had already been built. Housekeeping manuals and many periodicals also began devoting space to the subject of plumbing.8

The appearance of plumbing in print paralleled the appearance of plumbing in the home. By the early 1850s the number of water fixtures found in private homes ran into the tens of thousands, and by 1870 the quantity had risen considerably, a trend clearly documented by annual reports issued by municipal water boards.9 In 1847, for example, Philadelphians used an estimated 3,521 private baths.10 In 1853 the water registrar for Boston's Cochituate Water Board reported that customers were using over twenty-seven thousand plumbing fixtures, including sinks, wash basins, water closets, and showers; by 1870 that number had risen to more than 124,000.11 By the mid-1850s, customers of the Croton Aqueduct in New York were using 1,361 baths and 10,384 water closets.12 Almost twenty thousand water closets were in use in New York and Boston alone by about 1860.13 During 1861 Baltimore's 16,421 residential water customers purchased water for use in 2,644 baths and 820 water closets. A year later that city's water registrar estimated that in the calendar year 1863 the Board would collect rents on 3,604 baths and 1,260 water closets; in 1871 he announced that the city expected revenues on 5,486 bathing tubs and 2,596 w. c.'s for calendar year 1872.14 By the mid-1870s in Buffalo, New York, a city with a population of about 117,000, water takers employed over thirty-three hundred water closets.15 Nor was plumbing use limited to the citizens of the nation's largest cities. Across the river from Boston, by the end of 1871 Cambridge water takers were using water in 8,222 faucets and
slightly more than eighty-eight hundred other fixtures, including tubs, slop and water closets, and wash basins. An 1876 survey in Savannah, Georgia, revealed that the city's approximately 30,000 residents owned a total of 1,759 water closets.

These numbers pale when compared to the millions of fixtures that would be in use by the early twentieth century, and they seem small when compared both to total populations and to the total number of water customers in any given city; nonetheless, the numbers indicate a widespread interest in water fixtures during the middle of the century. For example, in 1861, when Baltimore residents used 2,644 baths and 820 water closets, the total number of residential water customers stood at 16,421 (at six people per house that totals slightly under half the total city population of 210,000), meaning that about a fifth of them used baths and closets. By 1871 the population had risen slightly, to just over 267,000, but the number of residential customers had climbed to 26,324 (more than half the population received water), and water closets and tubs in use stood at 8,032: about a third of Baltimore water takers had access to a closet or tub. In 1853, as the city's population neared 140,000, Boston's Water Board supplied water to over fifteen thousand buildings (mostly houses); these customers owned just under twenty-five hundred water closets. By 1870 the city's population had risen to slightly over 250,000 and Bostonians had installed over twenty-five thousand water closets. The Board supplied about thirty-thousand public and private buildings, including houses (22,846), banks, shops, and the like; these figures indicate not only that a majority of water takers were using w. c.'s, but also document a relatively rapid increase in the use of this technology. Similarly, by the mid-1870s in Buf-
falo, New York, when that city’s population topped one hundred thousand, city water flowed to just over five thousand houses, thirty-three hundred of which had water closets.20 Plumbing may not have been "democratic," but beginning in the 1840s a significant segment of the population had made the decision to use it. The question, of course, is why? Why this apparently sudden interest in plumbing, and why at that particular time? What prompted Americans to begin writing about and using plumbing during the 1840s?

The water works data reported above suggest a possible explanation. In the early part of the century a few municipalities, often aided by local entrepreneurs, built water works primarily as a way to protect property owners from fire and as a way to aid commerce and manufacturing. Beginning in the 1840s, however, Americans perceived a crisis in their cities as immigrants and other undesirables threatened community well-being; urbanites complained that tainted wells and ground water along with overcrowding and unacceptable sanitation practices posed public health problems on a scale that demanded municipally-sponsored action. In other words, mid-century cities used water works as a tool, a social service, one historian has labelled it, with which to alleviate urban chaos.21 As a consequence, the number of water works increased dramatically between 1840 and 1870: in 1840 about fifty existed in the nation, but during the next two decades that number more than doubled.22 And, as the figures cited above show, Americans used this water to do more than flush befouled streets and fight fires; they also filled sinks, tubs, and water closets. As noted earlier, it is difficult to determine the precise number of plumbing fixtures in use prior to the formation of a water works supervisory board, but common
sense dictates—and the figures above demonstrate—that once New Yorkers had access to Croton water, and Bostonians to Cochituate supplies, they began to install plumbing fixtures in record numbers. The answer to the question why?, seems simple: the construction of public works facilitated the use of water and prompted the adoption of plumbing technologies.

Unfortunately, that argument does not hold up under scrutiny. Americans living in very large cities used large scale water works as a tool for dealing with urban crises, but in smaller towns and villages like Portland, Maine, and Concord, New Hampshire, citizens continued to rely on wells and cisterns, both municipally and privately owned, because in those places immigration and sanitation problems did not create a crisis atmosphere. The appearance of water works in a few cities does not explain what was a nationwide interest in plumbing. That is, it may be true that the construction of a water works prompted people to install plumbing; it may even be true that the majority of mid-century plumbing users relied on water obtained from such a works. But in the middle decades of the century, Americans did not perceive a necessary link between plumbing and water works. Rather, they routinely constructed private household water systems to support their plumbing fixtures, a practice amply documented in contemporary magazines and books. A later chapter examines mid-century household water supply technologies in greater detail but now it may be useful to look at some examples of household plumbing used in conjunction with a private water source.

For example, in an 1849 collection of house plans, William Ranlett described two "cottages" with plumbing. For the first, a Staten
Island dwelling, the owner obtained water from a spring-fed brook adjacent to his lot. A fifty foot conduit of lead pipe carried water to a hydraulic ram, which pumped the water through 350 feet of pipe to an attic tank. Water flowed from the tank to a tub, a water closet, and the kitchen sink. Inhabitants of the second house, "Waldwic Cottage" in New Jersey, piped water from a nearby river. A pump and pipe arrangement transported water 450 feet to an attic tank, from which it ran throughout the house to sinks, basins, a tub, and a water closet.  

Andrew Jackson Downing described a similar arrangement in one of his books: the occupants of "Riverside Villa," located at Burlington, New Jersey, near the Delaware River, pumped their household water from the river; pipes carried the liquid throughout the house, which had a water closet and bathing room.  

Some house plans published in the 1850s outlined similar arrangements. The owner of a Troy, New York, "suburban cottage" piped water from a nearby spring to the house, where it fed the bath tub, the kitchen sink, and other fixtures. The "rural cottage" of Alexander Davis, located at Stuyvesant, New York, got its water from a well and a cistern. The kitchen sink drew water from both, as did, presumably, the bathtub and several wash basins located on the second floor. Phrenologist and octagonal house enthusiast Orson Fowler, who couldn't say enough about the pleasures of running water, installed cisterns and wash basins in five bedrooms, filling the cisterns with rainwater channeled from the roof. This same water, along with that from a well, also supplied a hot water heater, a water closet, and several cisterns and sinks located in the lower level of the house.  

Some houses built during the 1860s also relied on private
water. Occupants of a "country residence" located several miles from Baltimore stored water in a third floor tank and piped it to a second floor bathroom with tub and water closet, as well as the kitchen sink. Since "country" houses rarely had access to public water, the owner probably filled the tank with rain or well water. The occupants of a "suburban" Chicago home filled their water closets, tubs, and sinks with water provided by an attic rain-water tank. A "country residence" built near Orange, New Jersey, and a "villa" built at Bethel, Connecticut, both had hot and cold running water that ran from attic tanks to tubs, water closets, basins, and sinks. Since the former was located in a rural area, and the latter in a small town that had no public water works until the late 1870s, it seems safe to assume that the houses' owners pumped water into the tanks from private sources, probably wells and rainwater cisterns, but possibly from water sellers.

These examples do not exhaust those available but for now they serve three purposes. First, they demonstrate that some factor other than the appearance of water works prompted Americans to adopt plumbing. Second, they suggest that mid-nineteenth century Americans conceived of "running water" in broad terms; "running water" meant something more than the stuff that flowed from a publicly supported and maintained water works. Finally, these examples demonstrate the technological feasibility of using plumbing without the benefit of water from a large-scale engineering project such as the Croton Aqueduct. Later chapters discuss these three ideas in greater detail, but for now these claims suggest that there was no compelling technological explanation for the sudden interest in household plumbing beginning in the 1840s. If plumbing did not require the presence of a water works, and if Americans
created a variety of private water supply arrangements that supported plumbing, then, in theory at any rate, plumbing just as easily could have appeared any time before 1840. Once again, the question looms: how can historians account for the widespread interest in and use of plumbing in the mid-nineteenth century, an interest and use that began rather abruptly in the 1840s?

Historians mark the 1840s as the decade that initiated the modern American public health movement, an event that presents strong possibilities as the cause of plumbing's sudden popularity. During that decade large cities with their dense populations seemed to pose a health threat on a scale never before seen. John Griscom, Lemuel Shattuck, and others, apparently influenced by a concurrent British movement, agitated for health reforms. A severe cholera outbreak in 1849 along with Edwin Snow's discovery of the relationship between tainted water and disease strengthened the reform movement. Four "sanitary conventions" and the appearance of a few permanent full-time health boards in the late 1850s seem to represent the end result and the natural consequences of an entrenched public health movement.31

Although Americans expressed considerable concern about public health during the mid-nineteenth century, but there is little evidence to suggest those concerns prompted them to adopt plumbing. For the most part, the movement's activists aimed their rhetoric and actions at a specific segment of the community, namely the urban poor: reformers argued that substandard housing, unacceptable sanitary habits, and propensity for disease made the urban poor obvious targets for reform. No one, however, suggested targeting public health reforms or legislation at the whole community.32 For example, the movement's rhetoric
stopped short of advocating the regulation of private sanitation practices, and the national drive to require household plumbing, to license plumbers, and to establish mandatory uniform plumbing codes did not begin until the last two decades of the century.33 Few mid-century cities built unified central sewer systems or established municipally sponsored waste removal services, let alone tried to mandate the use of household plumbing as a way to achieve a higher standard of public health.34 As a possible explanation for plumbing's newfound mid-century popularity, public health falls well short of the mark.

Mid-century methods of dealing with private health, on the other hand, may offer more fruitful grounds for understanding the interest in plumbing. Throughout the nineteenth century Americans experimented with a number of health fads and sects, one of which was hydropathy, a medical treatment based on the curative powers of water that first gained American popularity in the 1840s. Eschewing "heroic" drug treatments, hydropaths used a variety of baths and bathing techniques, such as foot and eye baths, douches, plunges, and wet packs to restore good health. While cold-water cures formed the core of this regimen, hydropaths linked these treatments to a broader personal improvement plan based on exercise, temperance, good hygiene, and vegetarianism. Because water formed the heart of hydropathy, it stands to reason that adherents would adopt indoor running water and water fixtures in their homes, so it is possible that the national interest in hydropathy prompted the appearance of plumbing during the 1840s.35

It seems highly unlikely, however, that every plumbing user was also an adherent of hydropathy, so it is doubtful that the popularity of this medical philosophy was the only or even a major source of plumb-
ing's growing popularity. Moreover, hydropathy offered concrete advice about how to live a healthy life, but did not require the patient to commit him or herself either to an acknowledged healer or to a formal process of curing. Adherents need not embrace vegetarianism, temperance, or dress reform in order to benefit from hydropathy, nor did they have to install plumbing in order to take advantage of water's healing powers. Nonetheless, hydropathy's appearance and popularity in the 1840s provides important insights into the nature of mid-nineteenth century American society, insights that in turn help explain the appearance of plumbing.

Hydropathy encouraged patient participation in the healing process, and thereby fostered self-reliance, self-determination, and self-improvement. Water merely served as a means to the end of self-improvement at both the physical and spiritual level. Hydropathy achieved popularity when it did because mid-nineteenth century Americans believed firmly in the inevitable progress of American civilization, and in both the ability and the necessity of each person to contribute to that progress. Hydropaths, like abolitionists, vegetarians, phrenologists, and feminists, prison reformers, temperance activists, and communitarians, strived for individual self-improvement in the name of national progress. In that sense, then, hydropathy's emphasis on self-cure and hygiene served as manifestations of a larger set of cultural notions that articulated the value of self-improvement in the name of national progress.
Mid-century interest in self-improvement and national progress stemmed from a growing awareness of the United States as a unique civilization, one whose democratic institutions stood as a beacon of hope for the rest of the world. Put simply, mid-century Americans self-consciously identified themselves as parts of a national unit. According to one historian, this self-awareness emerged as one result of a "redivision, reclassification, and reorganization of society's nature" that occurred in the United States in the late 1830s, as the early nineteenth century American emphasis on the "individual" gave way to a recognition of Americans as members of a nation and the United States as a unique civilization. This awareness of a totality—a unified civilization—also implied the existence of a group, "Americans," as well as the existence of other groups of people living in the United States but not behaving in an "American" manner. This shift in ideas, Alan Marcus has argued, "had profound implications" for the nation, and Americans "accorded a high priority" to individual and "institutional reform," such as that expressed in food fads and hydropathy, and in the abolition and temperance movements. Urbanites, for example, identified the presence of "strangers," as contemporaries labelled them, as the cause of urban upheaval; strangers' unfamiliarity with American mores prompted those who did understand "America" to engage in a variety of activities that would educate or reform these ill-fitting members of society. At the same time, however, others recognized that the future progress of the nation depended upon the continued strength and well-being of each individual American; since moral fiber stemmed from family upbringing, the new national self-awareness also prompted a new interest
in the nature, activities, and structure of the American family. Reformers reasoned that if national progress depended upon the contributions of individuals, then the upbringing, socialization, and nurturing of those individuals became an activity fraught with important implications for the future of the nation, and the family, which shouldered this important burden, became the focus of intense scrutiny.  

Reform and the Family

Unlike other more formally organized reform drives of the mid-nineteenth century, the effort to establish a new model of family life was less a movement than it was an informal but nonetheless national reaction to and against forces that threatened American civilization and buffeted family life from all sides. According to one historian, those who touted family reform shared "the common conviction that the pace of social change at mid-century was too great." Changes in production techniques and workplace locations altered domestic life, and some family members began spending large parts of the day outside of the home at work or school. The early nineteenth century emphasis on individualism and associationalism had eroded traditional family hierarchy, and prompted the formation of new familial relationships. Reformers also believed that "outside forces that did not share traditional beliefs," or what Marcus called a "plague of strangers," threatened the very existence of American civilization, and thus, of course, the American family. This threat proved especially great at mid-century because "American society appeared to have outgrown the old standards for family life without having developed any new ones."  

Reformers based their efforts on the belief that the family served as "the pattern, the foundation, the beginning of all society, ...
In this institution, to which, more than to governments or to great men, the progress of humanity may be traced, centre [sic] those ties which connect the individual with the community at large.47 Andrew Jackson Downing, arguably the period’s most popular architectural writer, remarked simply that "whatever systems may be needed for the regeneration of an old and enfeebled nation, we are persuaded that, in America, . . . the distinct family [is] the best social form . . . ."48 Magazines and books, religious leaders and educators, analyzed the importance of family, and pondered its past, present, and future role in American civilization.49 When reformers scrutinized the family, however, they also pondered the meaning of "home." The inseparable institutions of home and family figured prominently in mid-century novels, short stories, poems, paintings, and even in political debates such as the one over slavery, and writers paid rhetorical homage to what contemporaries called "home feeling."50 "If it is true 'there is no place like home,'" wrote one observer, then "a person without a home is a special object of commiseration."51 The "HOME," commented one architectural instructor, is the "dearest spot on earth, the centre [sic] and sanctuary of our social sympathies."52 In an 1840 speech Daniel Webster explained his strong emotional attachment to the "remains" of the family log cabin where his brothers and sisters were born, and to which he made an annual pilgrimage. There, he said, "I love to dwell on the tender recollections, the kindred ties, the early affections, and the touching narratives and incidents, which mingle with all I know of this primitive family abode."53

But "home" was more than just a feeling; it was also a place, and it was toward that place that numerous writers, architects, and
others directed their attentions. During the middle decades of the nineteenth century, the dwelling house, site of the family's functions and center of "home," came under meticulous scrutiny as Americans attempted first to define and then to create that environment within which the American family could best flourish. This interest in the dwelling house prompted the introduction of plumbing into the American household.

Reform and the Family Dwelling

Virtually every mid-century architectural writer complained about the quality of the nation's domestic architecture. Citing ignorance on the part of builders and owners as a cause of this problem, they pleaded for the development of an "American" architecture, and for closer attention to beauty, taste, and the fundamental principles of architecture. Some historians have interpreted these architecturally-based complaints and the reform movement itself as an effort on the part of architects to gain professional credibility. That may be the case--after all, the word "architect" rarely appeared in print without the word "professional" preceding it--but focusing on mid-century pleas for professionalism obscures the structural underpinnings of the architects' complaints and their connection to both family and national reform: critics based their arguments on a specific assumption about the relationship between the domestic environment, individual character, and national progress.

Put simply, mid-century Americans believed if home and family functioned as the primary institutions for producing people with good morals and good character--as the building blocks of American civilization--then the American family deserved, no, required, a
domestic structure worthy of housing this important national institution. Architectural books published in the 1840s and 1850s paid homage to this idea, and Downing expressed the views of many when he wrote that "a good house . . . is a powerful means of civilization." The authors of the 1856 *Village and Farm Cottages* elaborated on that idea when they wrote that "... every improvement in the abodes of men, which renders them more neat, comfortable, and pleasing, contributes not only to physical enjoyment, but to mental and moral advancement." They insisted that any "enlightened plan for the advancement of family influences and of society in general" ought to include plans for the improvement of dwellings. . . . He who improves the dwelling-houses of a people in relation to their comforts, habits, and morals, makes a benignant and lasting reform at the very foundation of society. . . . [Homes], however humble, may teach lessons of neatness and order; they may and should inspire a regard for comfort and decorum.58

Orson Fowler developed a particularly complicated explanation of the relationship between domestic environment and character. People must have houses, he noted, and therefore "nature has kindly provided [them] with a BUILDING INSTINCT, called, in phrenological language, CONSTRUCTIVENESS." The expression of this instinct, and thus the complexity of dwellings, bore a close correlation to innate intelligence: the "half-human, half-brute orang-outang" builds "huts of stick and brushes," but the "Hottentots, Carib, Indian, Malay, and Caucasian build houses better, and still better, the higher the order of their mentality." Thus American dwellings, despite their imperfections, reflected a high level of development. Fowler nonetheless urged his countrymen to educate themselves in the principles of architecture and house design: convenience and proper arrangement of the house's parts, he explained, made the family "amiable and good," while a lack of sound
design "sour[ed] the tempers of children, even BEFORE BIRTH, by perpetually irritating their mothers" and making the whole family "bad dis-positioned."  

Catharine Beecher explicitly tied national progress to the ability of the American woman to manage house and family effectively. The progress and success of American civilization, as embodied in its "democratic institutions," she wrote, "depends upon the intellectual and moral character of the mass of the people." But the people's character, she added, was "committed mainly to the female hand" and therefore American women bore the "peculiar" responsibility of obtaining "a thorough practical knowledge of all kinds of domestic employments."  

"Our dwellings," noted one plan book author, "are the surest index of our civilization; . . . ." Another elaborated on this idea: "Nothing has more to do with the morals, the civilization, and refinement of a nation, than its prevailing Architecture. Virtue and Beauty are twin sisters; while Vice and Deformity are in constant association."

Creating the Good American Home

This linkage of character, family, and national progress prompted Americans to re-create, to re-form as it were, their domestic environments. To effect domestic reform, writers produced architectural books and housekeeping manuals in record numbers, and periodicals of all types routinely published house plans and discussions of "domestic economy." For example, popular magazines such as Godey's Lady's Book, Colman's Rural World, Scientific American, Harper's Magazine, and Country Gentleman published house plans both with and without descriptive texts. Some magazines borrowed their designs from plan books, but others solicited designs from readers or commissioned architects to create
original plans. Downing's architectural plan books enjoyed enormous popularity: his Cottage Residences, for example, first published in 1842, went through four revisions and the publishers issued the fourth edition eight times between 1852 and 1868. The Cleaveland-Backus text Village and Farm Cottages appeared four times between 1856 and 1870, and Orson Fowler issued his treatise on octagonal structures eight times in less than a decade, a publishing record shared by other books. Beecher's Treatise on Domestic Economy enjoyed similar success: it went through four printings between 1841 and 1843, and appeared almost annually, often in revised editions, through the mid-1850s. Nor did interest in these texts appear to be regional. Architects and builders in Illinois and North Carolina bought and used these texts, publishing houses in Cincinnati, Cleveland, and Chicago printed them, and local newspapers such as the Raleigh, North Carolina, Register carried advertisements for them. At mid-century, the notion of domestic improvement apparently met with nationwide public approval.

These mid-century books, magazines, and manuals supplied readers with house plans and building information, but they also outlined the basic principles of domestic economy and architecture, knowledge of which enabled American families to create homes that fostered "home feeling" and that provided a healthy, beautiful, comfortable environment within which to raise future generations of Americans. The texts offered readers general principles, rather than specific instruction, because, as one writer put it, "no two households are exactly alike in their domestic habits. . . . The fact that individual wants and tastes are infinitely varied, renders it impossible . . . to give . . . directions or plans that will exactly suit individual cases; . . . ."
As a result, advice tended to consist of a few broadly sketched guidelines. For example, writers stressed the importance of building on a healthy site, one that included adequate breezes, a good water supply, and dry, porous, and well-drained soil since swampy soil created a malarial environment that could endanger the inhabitants' health. Architectural texts urged readers to choose a house style that suited the site and matched the inhabitants' income. Domestic health also depended upon the proper arrangement of rooms, because, as Beecher warned her readers, "nothing is so expensive as sickness. Every arrangement [of the house], therefore, which tends to injure the health, is a serious violation of economy. It sacrifices not only health, but also comfort, time, and money. There is much bad economy, in this respect, in constructing houses." Correctly placed rooms and windows took advantage of prevailing winds and provided the inhabitants with plenty of health-giving light, but as another writer explained, "one of the most important principles of interior arrangement is the disposing of the rooms in such relative positions that the work of the family may be done with the least possible amount of labor." Downing stressed the importance of correct arrangement as a way to reduce dependence on servants, because, as Beecher and other writers pointed out, a dearth of competent servants threw the burden of household labor onto women, who were then too tired to perform their other familial duties as wife and mother.

Proper ventilation contributed to domestic health. Architectural plan books, domestic advice manuals, and magazines discussed this topic at great length and in minute detail. One of the subject's foremost experts described the problem of household ventilation as "one of
the most important objects of hygiene, [which] should be deemed an essential, and not a mere secondary question in all architectural structures."72 As one writer commented, drainage, cleanliness, and adequate water supplies were helpful, but they left "absolutely untouched the other and really important kind [of impurity] . . . namely, the filth and poison of the human breath."73 The need for adequate ventilation stemmed from the harmful consequences of breathing stale air. Mid-nineteenth century Americans understood air to be composed primarily of oxygen and nitrogen, and of smaller quantities of a third element, "carbonic acid." Relatively harmless when mixed with other gases or when dispersed freely throughout the air, carbonic acid became positively lethal in large doses. Without adequate ventilation, the room's air became polluted, "shak[ing] off those aerial wings, which would have carried it away . . . ."74 During cold weather months, closed windows, burning lights, and roaring stoves contributed to "the transformation of the life-giving element, with which the room was originally filled, into a subtile [sic] but active and powerful agent of disease and death."75 In this situation the inhabitants inhaled increasingly foul air, poisoning their bodies, and then exhaled it, filling the air with still more toxic gas.76 This vicious cycle led to lethargy, listlessness, headaches, intellectual torpor, and eventually to scrofula, consumption, and other diseases. An adequate household ventilation system prevented these problems.77
Convenience and the Good American Home

The principle of convenience served as another underpinning of a quality domestic environment. Architects and domestic experts regarded "convenience," a word that appeared repeatedly in architectural books and housekeeping manuals, as one of the "essentials of comfort," a lack of which threatened to destroy family happiness; a quality dwelling offered not just beauty and utility, but also convenience, without which beauty and utility amounted to little. Downing called convenience the "highest rule of utility," and urged "all persons, and especially ladies, who understand best the principle of convenience" to obtain at least some knowledge of architecture, of which convenience, or what Downing also called "rules of fitness," was one aspect. He explained that, like house design and arrangement, the particulars of convenience varied from family to family: "What may be entirely fit and convenient for one, would be considered quite unsuitable for another." For that reason, architects regarded convenience as one of the primary principles of architecture, and declared an understanding of it as essential for creating a good house.

Contemporaries defined a convenience as any thing or any arrangement that facilitated domestic labor, reduced dependency on servants, safeguarded the health of the family, and generally improved home life. The proper arrangement of rooms within the house clearly constituted one aspect of domestic convenience. But Americans also derived convenience from a variety of other arrangements and objects, usually labelled "conveniences" or, sometimes, "improvements," found inside and outside the house. The author of one housekeeping manual decried the "oppressions of those" who suffered from an "utter destitution of the
many and almost indispensable conveniences of domestic labor and economy." 81

Perhaps no water near the house, or if near, requiring all the strength to draw one pailful; no dry or hard wood, or not suitably prepared to burn, if dry; no drain for water, nor walks around the door, and perhaps not even safe and suitable steps, to say nothing of many other very great comforts and conveniences. 82

Convenience came in many forms. Miss Leslie's *House Book* pronounced household refrigerating devices "conveniences no family should be without." 83 An architectural text informed readers that "every cottage [should] have a door-bell. Its cost is small and its convenience great." 84 Beecher deemed nursery closets to be "very convenient," and a "dish-closet" positioned between dining room and kitchen "a great convenience." She termed the "sliding closet, or dumb waiter" a "convenience which saves much labor." 85 Other writers defined task-specific rooms, such as sink-rooms and butler's pantries, and room arrangements as conveniences. One writer decreed the small kitchen to be more useful than a large one as long as it had "proper conveniences" such as a "pastry-room, store-closet, . . . sink-room, and scullery" attached to it. 86 The text accompanying a published house plan touted the convenience of a butler's pantry attached to a dining room, especially since the pantry contained "all the necessary modern conveniences," including a dumb-waiter. 87 An article in a "rural" magazine urged readers to furnish their homes with household conveniences, including a wood house adjacent to the kitchen, a well with a good drawing apparatus, and "ample cisterns" connected to the kitchen "by means of good pumps." 88 Downing counted the dumb-waiter, the "speaking-tube," and the rotary pump as important conveniences. The pump, he explained, when installed "in some convenient position" and attached to a pipe and
an outside cistern, placed "an abundant supply of water within a few steps of every bed-room" of a house's upper floors. Another mid-century writer applauded the American "ambition to occupy a 'modern house,' . . . with the 'modern improvements,'" among which he counted hot-air, water, steam, and gas furnaces, speaking-tubes, ventilation systems, dumb-waiters, and "water-closets and bath-rooms . . . ."89

Plumbing Technology and the Idea of Convenience

These last three writers proved to be absolutely typical in their assessment of piped water and water fixtures as conveniences. Beginning in the 1840s Americans treated piped and running water and water fixtures such as sinks, water closets, and bath tubs as members of that category of things and arrangements defined as "conveniences." Indeed, the objects of plumbing—the fixtures, pipes, and pumps—almost always appeared in printed discussions coupled with the words "convenient" or "conveniences": the occupants of a New Haven house enjoyed the "very convenient addition" of a "gentleman's wash closet on the first floor." Architect George Woodward praised the kitchen of a Cold Spring, New York, house outfitted with a "sink and other kitchen conveniences," and a "suburban cottage" that had a "sink, pump, and other pantry conveniences."90 The "modern conveniences" found in the butler's pantry mentioned above included a sink with hot and cold running water.91 Architectural plan books routinely described water closets, bathing rooms, and sinks as "conveniences."92 In the Treatise on Domestic Economy Beecher included a description of an interior cistern and pump arrangement that supplied water to a sink and tub, and urged the woman of the house to "use her influence to secure all these conveniences."93 In an 1866 essay she noted that "the front wash closet is
a great convenience before and after meals . . . ."94 In his 1856 Architectural Instructor architect Minard Lafever noted that "within the past few years, more regard than formerly has been paid to domestic conveniences," among which he counted "the various modes of warming and ventilating buildings," as well as "the supplying of water to the several stories" of a building.95 An 1861 survey of American progress echoed Lafever's words; the author termed the "introduction of water from water works" a "labor-saving and convenient improvement in our modern domestic architectural arrangements . . . ." "The fountains thus set flowing," he continued, "save all water-carrying. . . . The burdensome daily details of housework are . . . greatly lightened, and health, and time, and exertion, very much economized . . . ."96

As these descriptions indicate, mid-century Americans linked the use of household running water and water fixtures to the concept of convenience. Convenience, however, had several faces. When embodied in a physical object—a "convenience"—it saved labor, and reduced the need for servants. As an abstraction, adherence to the "principle of convenience" embodied one route to better families and creation of "home feeling": the use of conveniences increased the amount of leisure time families had to spend together. Americans also linked the principle of convenience to good health and moral improvement, albeit indirectly: the elimination of unnecessary drudgery protected the health and well-being of women and enabled them to devote maximum effort to the important tasks of nurturing and moral guidance.

Finally, the introduction of conveniences enabled Americans to create homes whose modernity and comfort surpassed those found in Europe and Great Britain; speaking tubes and plumbing fixtures served as tools
with which to affirm the distinctive character of American civilization
and the American people's dedication to progress and improvement. In
that sense, then, the project of domestic reform—that is, reform
directed specifically at the house and family—represented just one com-
ponent of the larger ongoing task of national improvement. In the
1830s and 1840s Americans regarded themselves not just as a people with
a mission, but a people whose past and future distinguished them from
other nations and peoples. Americans were a unique people "uniquely
free to achieve the goals that other nations had not been able to reach" not just because of the vitality of their democratic institutions but
also because, for Americans, the future was "freed from the encum-
berances of the past." This view of the future enabled Americans to
perceive progress as both "kinetic" and potentially malleable. People
"could change the character and quality of [their] institutions to make
them new and different in result and kind." The material alteration
of the home exemplified the American dedication to progress and the
future, and symbolized the differences between young modern America and
old decaying Europe.

Beginning in the 1840s, then, Americans adopted in-house run-
ning water and water fixtures as tools with which to render their homes
convenient, an impulse which itself stemmed from a broader desire to
create excellent domestic environments and thereby effect national pro-
gress. As later chapters will show, the technology of mid-century
plumbing was not particularly new; indeed, for the most part permanently
installed bathing tubs and sinks replicated the portable objects they
replaced, and while it is true that plumbing-related patents increased
beginning in the 1840s, those patents were the consequence, rather than
the cause of a new interest in plumbing. Put simply, at mid-century Americans began to install the water closet, tub, and pump, as well as the dumb waiter, speaking tube, and furnace, as part of a contemporary effort to reform and improve American domestic life, and it is within the dual contexts of reform and convenience that the appearance of plumbing is best understood.
Endnotes


There are a couple of exceptions to the general claim that the builders' manuals ignored plumbing. Edward Shaw's Civil Architecture, which first appeared in 1830, included a section entitled "Plumbing." In it Shaw described the plumber as one primarily concerned with "pump-work" and with "the making and forming of cisterns and reservoirs, large or small closets, &c. for the purposes of domestic economy." But the text focused primarily on the properties of lead and other metals, and the tools and techniques used in working with them. See Shaw, Civil Architecture; or, A Complete Theoretical and Practical System of Building, . . . (Boston: Marsh, Capen and Lyon, 1834), 148. Another builders' manuals, Chester Hills' 1834 Builder's Guide, showed two water closets on the floor plan of a "castellated Gothic Villa." Hills defined the Gothic style as "more properly called, British Architecture," and the house plan itself may have come from a British text. In any event, these two examples were the exception to the general tendency to ignore sinks, closets, and other water fixtures in the early century manuals. See Chester Hills, The Builder's Guide; or A Practical Treatise on the Several Orders of Grecian and Roman Architecture, Together With the Gothic Style of Building (Hartford: D. W. Kellogg and Co., 1834), 23 and Plate 25.


5Bushman and Bushman, "Early History of Cleanliness," 1214-17, 1225.

6The best discussion of hotel plumbing, especially as found in the 1830s, is in Jefferson Williamson, The American Hotel: An Anecdotal History (New York: Alfred A. Knopf, 1930), 55-56, ff. An excellent contemporary description of hotel plumbing is in William Harvard Eliot, A Description of Tremont House, with Architectural Illustrations (Boston: Gray and Bowen, 1830), 13-16. Also see Bushman and Bushman, "Early History of Cleanliness in America," 1215.


9Annual reports published by municipal water boards are an enormously useful source of information because the boards often
required the "water registrar" to keep tallies of the number of fixtures being used in customers' homes; the resulting information appeared in the annual reports. Sometimes, but not always, the registrar broke this information into specific categories of fixtures, so that in Boston, for example, the annual reports included tallies of bath tubs, showers, sinks, various kinds of water closets, and so forth; in other cases, the registrar simply counted the fixtures as a single group. Reports such as these do have one drawback. Registrars were only interested in and had access to the fixtures used by paying customers, so that water reports do not include information about city residents who obtained water from other sources, such as private water sellers, backyard wells, and the like.


13 Martin, Standard of Living, 111-12.

14 The Baltimore water registrar typically only recorded the number of new water takers each year, and he only specified the number of plumbing fixtures for which customers paid extra, in this case water closets and tubs, so that figures are harder to calculate for that city. Since bath tubs and water closets used a great deal of water, water boards almost always charged an extra fee for them over and above the flat water rate. City of Baltimore, "Annual Report of the Water Department of the City of Baltimore to the Mayor and City Council of Baltimore," in Annual Reports of the City Departments (n. p., 1861), 380; Baltimore, Water Department, Annual Report of the Water Department of the City of Baltimore, to the Mayor and City Council of Baltimore (Baltimore: James Young, 1863), 11; and Report of the Water Department to the Mayor and City Council of Baltimore, for the Year Ending Oct. 31st, 1871 (Baltimore: John Cox, 1872), 40.


Schultz, *Constructing Urban Culture*, 166.

The social service interpretation is in Alan I. Marcus, *Plague of Strangers: Social Groups and the Origins of City Services in Cincinnati, 1819-1870* (Columbus, Ohio: Ohio State University Press, 1991), xix, but also see 144-46.


Andrew Jackson Downing, *A Treatise on the Theory and Practice of Landscape Gardening . . . With Remarks on Rural Architecture* (New


33 A later chapter discusses municipal regulation of plumbing, but a survey of late century plumbing codes is in Charles Chapin, Municipal Sanitation in the United States (Providence, Rhode Island: The Providence Press, 1901), 221-61.


36 Cayleff, Wash and Be Healed, 44-48.


38 Hydropathy's specific relationship to other reform drives is discussed in Cayleff, Wash and Be Healed, 109-39.

Harper Torchbooks, 1974), 3-6, 10-18 (page references are to paperback edition); Ekińch, The Idea of Progress. 38-41, passim.

40 Marcus, Plague of Strangers, 39. For his discussion of family reform in particular see 75-77.

41 Ibid., 70-81, passim.

42 For surveys of the mid-century family reform effort see Wright, Building the Dream, 73-89; David P. Handlin, The American Home: Architecture and Society, 1815-1915 (Boston: Little, Brown and Co., 1979), 4-88; Clark, American Family Home, 15-47.

43 Clark, American Family Home, 15.

44 One of the most important discussions of changes in family structure and in family-community relationships is in Mary P. Ryan, Cradle of the Middle Class: The Family in Oneida County, New York, 1790-1865 (Cambridge, England: Cambridge University Press, 1981), esp. 52-75 and 141-42. For a good discussion of changes in the workplace, especially in relation to the family, see Stuart M. Blumin, The Emergence of the Middle Class: Social Experience in the American City, 1760-1900 (Cambridge: Cambridge University Press, 1989), 68-107.

45 Clark, American Family Home, 15; and Marcus, Plague of Strangers, esp. 10-12 and 72-75.


50 For a discussion of "home feeling" and the metaphorical and literary uses of home and family see Handlin, The American Home, 11-19, 21, 23-24, and 63-84.


62 Smith, *Domestic Architect*, iii.

The Hitchcock catalog of architectural books documents the immense popularity of these plan books; it lists every edition of every book that appeared. See Hitchcock, American Architectural Books.

Sklar, Catharine Beecher, 151 and note 1, page 305.


For Downing's argument see Cottage Residences, 13. For Beecher and others see Beecher, Treatise on Domestic Economy (1841), 269-73; Wheeler, Rural Homes, 19-26; Vaux, Villas and Cottages, 41-44;


Letter from Dr. Arnott, cited in Bullock, American Cottage Builder, 179.


Jacques, The House, 36.


Discussions of ventilation typically were closely tied to the topic of heating. Most of the sources already cited included descriptions of heating technologies and their relationship to ventilation, but especially see Griscom, Uses and Abuses of Air, 228-42; Downing, Architecture of Country Houses, 475-81; Wheeler, Rural Homes, 172-85; Ferguson, "Historical Sketch of Central Heating."


81 Abell, *Woman in Her Various Relations*, 75.

82 Ibid.


91 "Two Adjoining City Dwellings," 301.


It is worth noting that many of those who issued domestic advice manuals and architectural plan books perceived the project of domestic reform as just one part of the much larger task of national self-improvement. Andrew Jackson Downing, for example, treated the house—and the problem of "American" architecture and good taste—as one component what might be called aesthetic self-improvement. He edited The Horticulturalist, a "rural" journal devoted to the improvement of rural and country life, and his books examined not just architecture itself, but also landscape gardening and the environment within which buildings sat. Orson Fowler perceived reform as a project that encompassed the totality of the individual. His "interests included phrenology, and the correction of perverted sexuality," as well as home construction and home ownership, hydropathy, and diet. His Home for All promoted the use of cement in house construction and the octagonal shape, which, he claimed, provided more living space and a more pleasant domestic environment than conventional rectangular or square houses. Catharine Beecher was another domestic reformer who treated reform as a project that went beyond the four (or eight) walls of the house: she campaigned strenuously for better female education. Lewis Allen, whose 1852 Rural Architecture appeared eight times in just over a decade, shared Downing's interest in rural improvement, although he devoted his efforts to farming and stock breeding.

For Downing's views see Handlin, American Home, 30-38 and 40-42; Cohn, Palace or Poorhouse, 63-88; Jackson, Crabgrass Frontier, 63-66. For Fowler see Cohn, Palace or Poorhouse, 83-85; the quote is on page 85. For Beecher see Jackson, Crabgrass Frontier, 61-63; and Sklar, Catharine Beecher, 170-82. For Allen see Cohn, Palace or Poorhouse, 83-85; and "A Grand-Island Home," Country Gentleman 7 (1856): 377-78.

"A water-closet, or its equivalent, is an absolute necessity in any house that is proposed to be a convenient and agreeable residence," wrote Calvert Vaux in 1857, but, noting that there was "always an expense, in arranging a regular water-closet," he suggested the invention of "some simple plan" that would "approximate" a closet's "advantages" at a lesser cost. Architect Henry Hudson Holly sounded a similar note in 1863. He recommended against installing "extensive plumbing" in a house "unless it [could] be ascertained that the means for repairing are at hand," and he omitted bathing rooms from some houses "on account of the expense." The Vaux and Holly comments neatly capture the limits of the idea of convenience in mid-nineteenth century America. Put simply, one person's convenience was another person's luxury.¹

Categories and the Limits of Reform

The limits of convenience stemmed in part from the obvious limits of the "domestic reform" effort detailed in the previous chapter. Not every American woman could afford the luxury of total devotion to the domestic sphere, nor could all families enjoy the luxury of leisured togetherness in a comfortable home outfitted with all the modern conveniences. More importantly, Americans did not expect all of them to participate in the effort to reshape home and family. Magazines arti-
cles and books touted the virtues of furnaces, dumb-waiters, and water closets as the necessary weapons with which to foment domestic reform, but their authors wrote for a select group. The expectation that only some Americans would or should embrace domestic reform stemmed from what can be termed the principle of classification: in the 1840s and 1850s Americans viewed their society as composed of different groups of people. Contemporaries spoke of the "laboring class," the "farming class," the "business class," the "dangerous classes," and so on. These distinctions, which Americans apparently perceived as the natural pattern of society, had less to do with wealth—although often a correlation existed—than they did with occupation and what might be termed "attitude." As a result, reformers regarded the domestic improvement effort in general and the adoption of water fixtures in particular as activities with limited appeal. They assumed that only some families would understand the national importance of domestic reform, would understand that domestic reform was less a choice than a necessity: the future of the nation depended in part on their efforts to protect and nurture the American family. For those families, conveniences were necessities. On the other hand, advice manuals, some magazines, and the architectural plan books seldom addressed the problems or needs of the wretched huddled in the urban tenement, because the texts' authors recognized that those types of people had little to contribute to family reform; indeed, the tenement constituted part of the crisis that threatened national well-being, and, by extension, the family unit. Dumb-waiters and speaking tubes solved the problems of some family types, but not all. Manifestations of this principle of categorization are best seen by looking at the domestic reform movement's primary
treatises, the architectural plan books, and at the process of economic and material differentiation in mid-century America.

Categories, Classes, and Architecture

Mid-century architectural plan books often included a paen to home ownership and the single family dwelling, but their authors treated "dwelling" as a highly relative concept: wealthy people built and owned large, often ostentatious homes, while mechanics and laborers lived in "tenements" or in small two or three room structures. By mid-century, the American house embodied "general cultural values, particularly as an index of progress, . . . " and "particular house-types . . . had become associated with particular values, . . . ." 4 Hence, mid-century architectural writers targeted both their books and their house plans to specific people and situations: they defined styles of houses, such as Italian, Norman, Gothic, Swiss; they established categories of houses, such as rural, suburban, cottage, city, villa; they assigned dwellings to different categories of people—laborers, mechanics, businessmen, as well as to different categories of places—city, suburb, country, farm, and village (Fig. 2. 1). 5

The homes that Americans built thus ranged over a wide continuum, and contemporary architectural writers understood and responded to the varieties of that continuum, just as they understood and responded to the fact that while houses within a category might be similar, houses of one category differed from those of another. For example, the authors of a collection of plans for "village and farm cottages" included houses designed for "a family of the smallest size and most moderate aims," for members of "a numerous, but active and earnest class . . . compelled to make the most of their means," and for persons
Fig. 2.1 A "suburban cottage" from Vaux's Villas and Cottages
Fig. 2.2 Jacques’ *The House* showed this suburban cottage of “substantial” “employment and character.” Another book included plans for rural and suburban cottages, country and suburban houses, town houses, and villas (figs. 2.2 and 2.3). In his *Homes for the People*, Gervase Wheeler included designs for suburban villas, country villas, “villa-like” houses, city houses, and cottages; he also delineated the three “classes” of people most likely to build in the country. Wheeler omitted house plans for the “poorer class,” explaining that their situation posed an architectural problem beyond the scope of his work, but he did offer his readers a design for “a tenement-house suited for respectable families of limited means.” “Laborer’s cottages” and homes for the “mechanic or clerk” routinely figured in the pages of mid-century architectural books. One writer noted that although the “subject of house building” commanded “the attention of all classes in the community,” few books on the subject met the needs of “the multitude,” a sentiment echoed by another architectural writer who dedicated his book to the “working classes.” William Ranlett created the plans in his
Lewis Allen dedicated his 1852 *Rural Architecture* to farmers, whom he described as the nation's "life-sustaining" and "large and important" class of people.12 The authors of another book offered their work to "a class, numerous and important in every community, . . . comprehending mechanics and tradesmen of moderate circumstances, the small farmer, and the laboring man generally."13 This categorization of houses, people, and places reflected contemporaries' understanding of the principles of architecture: ideally, the occupation and income of the inhabitants, as well as the chosen site, determined the size and style of a house. But the architectural "principle" itself

![Fig. 2.3 A "gothic villa" from The House](image)
constituted a subset of the broader mid-century principle of categorization; and architectural writers were responding to on-going processes of mid-nineteenth century material, social, and economic differentiation.

Material Differentiation and the Consumers of Convenience

To whom did the architectural plan books and domestic advice manuals speak? The extremely wealthy obviously possessed the financial wherewithal necessary to enjoy domestic ease and to purchase and maintain conveniences such as furnaces, running water, and water fixtures. Moreover, as noted in Chapter One, in the late eighteenth and early nineteenth centuries some well-to-do Americans had constructed private water systems and seemed willing to experiment with plumbing. But beginning in the 1840s the group of American plumbing users expanded in both size and diversity, as demonstrated by both the variety of contemporary published house plans that included plumbing and the number of actual users. Not every American began to use plumbing, of course, but the group of those that did now included much more than the very wealthy.

One category of plumbing consumers can be identified by returning once again to the principle of categorization outlined earlier. The American antebellum pattern of residential and social differentiation also manifested itself in a growing tendency toward what Stuart Blumin has described as a "divergence of economic well-being and opportunity" and a "bifurcation of work experiences and environments . . . ." among American urbanites. This bifurcation fostered the appearance of two increasingly distinct categories of people: "manuals," persons who worked with their hands for wages, and "nonmanuals," people who did "head," rather than hand work, for salaries, rather than wages, and
whose appearance, according to Blumin, marked the formation of an American middle class.14

During the antebellum years, "increasing economic specialization" fostered the separation of "work" from "home," at least for urban nonmanuals.15 Moreover, entrepreneurs and manufacturers contributed to workplace differentiation by physically separating the activities of sales and management from the activities of production. More and more, nonmanuals spent their work days primarily with other nonmanuals and often in relatively luxurious surroundings.16 Indeed, some firms advertised the grandeur and modernity of their sales rooms and offices more than the products themselves.17 A growing array of consumer goods sold in sumptuous display rooms influenced not only the employees who worked in them, but also those who shopped there: women with the leisure and money necessary for recreational shopping enjoyed this activity in commercial spaces designed to entice spending and make them feel comfortable.18 White-collar workers spent their days in modern "business buildings" outfitted with water fixtures, heating, and lighting, and returned at night to domestic interiors increasingly devoted to material comfort.19 Moreover, many nonmanuals lived in hotels that featured the most up-to-date accoutrements such as water fixtures, lighting, and heating; if nothing else these plush but often temporary surroundings likely raised people's expectations about what a decent home ought to look like.20 Even places like passenger steamboats, railroad cars, and photography studios provided members of the domestically-oriented "nonmanual" class with a model of material comfort which they could duplicate in their homes.21 These social, economic, and material circumstances created "an axis of respectability, stretch-
ing from the parlors of upper- and middle-class homes to the interiors of downtown retail stores, ..."22 In the mid-nineteenth century the "setting of domestic life" became "distinctly different for manuals and nonmanuals, if not by intention then at least because one group but not the other was able to buy the domestic interiors and household locations that permitted the fulfillment of a mid-century domestic ideal."23

Blumin's study concentrated on urban dwellers, particularly those in what were then the nation's largest cities, but clearly the "nonmanual" group extended beyond the borders of New York and other "great cities." Lawyers, bankers, clerks, and retailers could be found anywhere and it seems reasonable to assume that people residing in the hundreds of smaller cities, towns, and villages that dotted the American landscape expressed an interest in both material "respectability" and in national progress and domestic reform. But as evidenced by the number of advice manuals and house plans devoted to rural and farm life, the task of domestic improvement went well beyond the confines of cities and urban dwellers who worked for wages large or small. Journals such as The Horticulturalist and The Country Gentleman routinely touted domestic improvement to their readers, many of whom, presumably, lived beyond the great cities on farms, in small villages, and in the netherworld of mid-century "suburbs." Finally, it seems equally reasonable to assume that at least some "manuals" expressed an interest in—and possessed the financial wherewithal to invest in—domestic reform at some level, even if that investment consisted of nothing more than installing a pump next to the kitchen sink. Certainly the diversity and range of advice manuals published at mid-century suggests that reform writers perceived
their audience as a collection of varied types, rather than as a homogeneous singular entity.

But respectability was bought, not given, and ultimately, of course, the ability to purchase water fixtures depended less on where a person worked than on how much he or she earned, and how much of those earnings could be devoted to "non-necessities." People with small incomes generally spend large portions of their earnings on necessities such as food, fuel, and lodging. As incomes rise, the proportion devoted to these necessities decreases and families can channel more money into non-necessities. Statistician and later United States Commissioner of Labor Carroll D. Wright documented this tendency in an investigation conducted in the mid-1870s, just after the period being examined here. Wright studied the spending and saving habits of almost four hundred "working class" families, a collection of wage earners employed in skilled and unskilled labor, whose annual incomes ranged from about four hundred to almost a thousand dollars. He discovered that most of the families "spent 51 to 64 percent of their funds on food alone and over nine out of every ten dollars on food, clothing, and shelter. . . ."24 For the highest income families in the study, however, the percentage devoted to subsistence decreased, the amount for clothing and housing stayed about even, and the portion of income spent for "sundries" increased. Defining sundries as anything that did not fall into one of the other categories, such as liquor, tobacco, club memberships, books, furniture, and, of course, items such as sinks, washbasins, and water closets, Wright determined that families at the bottom end of the study group spent as little as thirty-two dollars a year for sundries, while one family at the top end spent two-hundred and
fifty dollars (much of it, according to the study, as servant's wages.) In Wright's study, only the few families at the top end of the scale could realistically contemplate adding plumbing and water fixtures to their homes. These top earners found work as factory overseers and as "high-income skilled workers in the building, shop, and metal-working trades," and thus occupied a kind of limbo: they did not fit the pattern suggested by Blumin's analysis of nonmanuals, but their income, and in the case of the overseers, their jobs, made them eligible to participate in some nonmanual experiences, and, should they choose, in the task of progress through domestic improvement.

Although Wright conducted his study in the mid-1870s, or after the middle decades of the century, his figures are not as problematic for this study as they appear to be at first glance. The skilled workers in his study earned between $560.00 and about eight hundred dollars. Other studies have indicated that around 1850 a New York City male working in skilled trades earned about three hundred dollars a year, but Blumin argues that because that figure includes the lower wage levels of unskilled and semi-skilled workers, a skilled worker in 1850 (in an urban setting) actually earned as much as five hundred dollars annually. All other things being equal, in the middle decades of the century, as in the mid-1870s, a wage-earning skilled worker was unlikely to have the disposable income necessary to support an in-house plumbing system. It appears, then, that mid-century plumbing users came largely--although perhaps not exclusively--from the ranks of nonmanuals.

Even at the bottom end of the "nonmanual" category, people earned more than their contemporaries who were skilled manual workers. Blumin cites the example of one Edward Tailer, employed as a clerk by a
New York dry goods importer. According to Blumin, "entry level" non-manuals such as Tailer fully expected to pass beyond clerking and go into business for themselves. Tailer probably viewed his starting wage of fifty dollars a year as a token apprentice salary, and indeed, within just a few years Tailer's earnings already totaled over a thousand dollars a year, and by the age of twenty-five he had left employment to start his own business. Other nonmanuals shared Tailer's employment history and salary: salaries of close to two thousand dollars were not unusual for clerks, retailers of various stripes could expect to make anywhere from three to six thousand dollars annually, and of course at the top end of the nonmanual category bankers, investors, importers, and others earned annual incomes in the tens of thousands of dollars.29

This assessment of incomes leads to an obvious conclusion: the mid-nineteenth century's burgeoning "white collar" class constituted the primary, although surely not the only, consumers of the convenience of plumbing. Salaried workers--nonmanuals--enjoyed a "disposable" income, in part because they could afford to live in outlying neighborhoods where land and housing were cheaper. They lived in larger houses than manuals, and, unlike manuals, they dedicated their houses to domestic life.30 Finally, in their workday environments and their recreational activities--such as shopping and steamboat excursions--nonmanuals routinely confronted a model of modernity and convenience that influenced their ideas of domestic comfort, ideas prompted and shaped by the mid-century domestic reform effort. But given the broad nature of the reform effort, it seems reasonable to assume that some "manuals" also participated in the project of domestic improvement. Certainly, as this and other chapters will show, the lack of uniformity in plumbing
fixtures and plumbing installations indicates that the group of mid-
century plumbing users was anything but homogeneous.

**Categories and the Limits of Convenience**

The dual processes of categorization and differentiation shaped
the limits of the reform effort, and, by extension, the use of con-
veniences, including who enjoyed plumbing and how they used it. Put
simply, the convenience of plumbing appeared in some but not all types
of houses. Americans expected the owner of a country "villa" or estate
to install bathing rooms, water closets, sinks, and other "appendages,"
but they did not expect to find these same conveniences in the modest
home of a "mechanic" or "laborer." Nor did mid-century Americans assume
all consumers of conveniences would use the same type and quantity of
fixtures. Instead, the diversity of fixtures and installations paral-
leled the diversity of people who used them.

For example, William Ranlett’s 1847 collection of house plans
included a set of four "cottages" being built on Staten Island. The
architect assigned each cottage two "water closets," but placed them
inside a detached wood shed located behind the dwelling itself. But an
"Anglo Italian villa," an elaborate structure with numerous bedrooms and
dressing rooms as well as a grand staircase, a parlor, and a drawing
room, had two in-house cisterns as well as a second-floor combination
bathing room and water closet.31 "Villas" shown in Samuel Sloan’s 1852
*Model Architect*, several of which had actually been built, included
bathing rooms and water closets, but a "plain dwelling" for a "family of
six persons, including a servant" had a second floor bath room and two
one-seat "water closets" behind the kitchen, and a set of designs for a
"laborer’s home" contained only a one-seat privy or water closet behind
the kitchen, but no bathing room. In Sloan's 1861 collection of
designs, plans for a cottage for a "mechanic or clerk" included neither
bathing room nor water closet (fig. 2.4). On the other hand, his design
for a farmer in "easy circumstances" boasted an attic cistern, kitchen
boiler, and second floor bathing room with hot and cold water.
Another architectural book included a "cheap cottage plan" and a "small
cottage" for a "mechanic or laborer" of "limited means"; neither one had
any plumbing, but more elaborate "cottages" of many rooms and several
floors and still-more elaborate villas included bathing rooms, water
closets, boilers, and other conveniences. An 1846 New York real
estate advertisement offered a house with "water, range, boiler, bath,
w. c.'s . . . and every other improvement introduced into modern built
houses of the first class." Plans for a "plain and cheap" Mas-
sachusetts house and for three "cheap tenement houses" showed neither

Fig. 2.4 A home for a family of "moderate aims," shown in
Cleaveland's Village and Farm Cottages
bathing room nor water closet, while "city" houses designed for both the "wealthy" and persons of "moderate" income included wash basins, bathing rooms, and other conveniences (Fig. 2.5).\textsuperscript{36}

As these examples demonstrate, mid-nineteenth century Americans treated plumbing as necessities for the few; they expected to find running water, bath tubs, and water closets only in certain types of houses. This pattern of selective, rather than universal, use encouraged a second important consequence of categorization: since Americans treated water fixtures as necessities for the few, they regarded it as unnecessary to devise formal or legal standards, such as plumbing codes, with which to govern their use.\textsuperscript{37} Moreover, while certain classes of homes had water fixtures, the number, type, and arrangement of conveniences actually used in those homes depended entirely on individual choice; a family's ability and willingness to pay defined the limits of convenience. As a result, a "standard" plumbing installation simply did not exist; indeed, writers used the noun "conveniences" to describe water fixtures far more often than they used the word "plumbing," especially during the 1840s and 1850s. The people who used these conveniences did not install "plumbing systems"; instead, they bought and used one or more discrete and specific objects--which belonged to a larger category of things called conveniences--in order to perform certain discrete and specific tasks. These conveniences included, but were not limited to, supply and drainage technologies, such as attic cisterns and cesspools, and "water fixtures," such as bath tubs, washbasins, and water closets. A homeowner selected these conveniences after considering several factors: how many could the family afford?
Fig. 2.5 This "city house" for persons in "moderate circumstances" had many conveniences, including a furnace, dumb waiter, and washbasins. From Sloan's City and Suburban Architecture
Which conveniences, and how many of each, did the family want or need? Where would the water come from? What kinds of drainage facilities were available? As a result, household water supply and disposal installations varied widely. And, as with houses, the type and number of fixtures used by people within a "class" tend to be similar; it is possible to discern general tendencies within a class, although the typicality of one class differed from that of another. This pattern is best understood by looking at some specific water supply and fixture arrangements.

The Beecher and Allen Arrangements

In her Treatise on Domestic Economy, Catherine Beecher included a simple but practical water fixture-water supply arrangement for a cottage residence, which she defined as a house in a suburb or village, or in the "country," rather than in the "city." Designed to secure "water with the least labor," Beecher's arrangement used water pumped from either a well or an underground cistern (Fig. 2.6). A reservoir, to "be filled once a day, . . . by a man, or boy," stood next to the pump, while a multi-branch supply pipe channeled the reservoir's water into various fixtures. One branch carried cold water to a nearby sink, while a second one conducted water into a boiler adjacent to the reservoir. The main branch of the supply pipe ran through a wall and carried cold water to a bath tub in an adjoining room, while a separate pipe carried hot water from the boiler to the tub; family members used a stop-cock to siphon off hot water as needed. "By this arrangement," explained Beecher, "great quantities of hot and cold water can be used, with no labor in carrying, and with very little in raising it." The household's
Fig. 2.6 Beecher's Treatise on Domestic Economy urged women to "secure all these conveniences"

conveniences also included two privies, installed in small compartments just off the bathing room (which was itself behind the kitchen and next to the "woodpile"). This single floor arrangement kept pipe work, and thus cost, to a minimum, and Beecher further minimized costs by using privies, rather than expensive mechanical water closets. In his treatise on rural architecture, Lewis Allen included similar water supply arrangements, which he regarded as especially suited to the needs of people living on large tracts of land. Allen, too, distinguished between "city" and "country" houses, and argued vehemently that differences between the two types necessitated different arrangements of water fixtures:

In city houses . . . the bathing-rooms are usually placed in the second . . . story, and the water for their supply is drawn from cisterns still above them. This arrangement, in city houses, is made chiefly from the want of room on the ground floor. . . . In the farm . . . or country house . . . such arrangement is
unnecessary, . . . because there is no want of room on the ground; expensive, because an upper cistern is always liable to leakages, . . . and inconvenient, from the continual up-and-down labor of those who occupy the house, . . . .

The Bickford House

Not all homeowners had to or wanted to settle for such (relatively) simple single floor arrangements. When William Bickford of Worcester, Massachusetts, built his "Italian villa" in the late 1840s he installed a more elaborate configuration of fixtures than the ones outlined by Beecher and Allen. Although Worcester, with a population of about twelve thousand, already had a public water system, Bickford supplied his fixtures with private water. Why he did is not clear: perhaps he lacked access to a main, or resented paying for public water when he had a usable well and ample rain water. In any case, two copper pumps attached to the sink provided "hard" and "soft" water from both a well and a brick and cement cellar cistern; the latter received its water from roof conductors. Unlike Allen, Bickford apparently believed the advantages of an upstairs bathing room and an elevated cistern outweighed the drawbacks, because his family used a force pump to transfer water from the cellar to a five hundred gallon cistern located above the bathing room. Pipes carried water from that cistern to the bathroom, which housed a tub and a "small sink . . . with a pipe and faucet for the purpose of drawing water from the upper cistern," and to other fixtures throughout the house, such as washbasins. Waste water flowed into a cellar drain, "eight inches square, well stoned and covered; . . ." and from there presumably to a cesspool. The family used a first floor "water closet" located just outside the back door; the w. c. may have been a simple privy, since there is no indication that any of the supply
pipes carried water to it.40

The Rogers House

Bickford’s use of conveniences differed considerably from those found in the Boston home of H. B. Rogers. In 1852 Rogers hired Daniel Davies, a Boston "housewright," to remodel his Joy Street home, perhaps in preparation for receiving "city" water from the Cochituate works, since much of the work involved replacing or adding water fixtures, pipes, and drains. Rogers apparently expected the Cochituate works to provide good water pressure, because he dispensed with pumps and attic cisterns. The house already had one third floor water closet, but Davies’ crew remodeled and enlarged that space to make room for new fixtures, including a "shower bath," a sunken tub with cover, a porcelain wash basin with marble slab and "plated facets [sic]," and a new water closet. The contractor installed sinks in the kitchen and washroom, and outfitted both with lead pipes, brass fittings, and a "cesspool strainer." A sixty gallon copper boiler and a water back located in the kitchen supplied hot water to the third story bathing area, and to a new bath room in the basement. In the basement bath, the workers installed a pan water closet with a twenty-gallon cistern and "all the usual fixtures and apparatus," a lead-lined bathing tub with brass fixtures, and a porcelain wash bowl. To prevent water damage caused by leaks, they lined the closet floor with a "safe," a lead floor covering whose edges ran up the wall a height of three inches. Below the basement, in the cellar, Davies and his crew filled in an existing well and removed a pump. Two-inch drain pipes carried basin, tub, and sink wastes to "the main drain in the cellar," and a separate drain carried water closet wastes to a cesspool.41
A final example comes from a set of plumbing specifications included in an 1869 collection of house plans published by George E. Woodward. "Design No. 1," a two-story frame house, used water from a cistern, a well, and an attic tank to supply a number of water fixtures, including a second floor copper bath tub, shower, pan water closet, and marble washbasin, as well as two separate but adjacent water closets located off the first floor washroom (Fig 2.7). Tin leaders carried rain water into the ten-foot-by-ten-foot underground cistern, while two sets of lead pipes, each 1 1/4-inches in diameter, channeled water from the cistern and the well to a "combination lift and force pump" that stood next to a cast-iron sink in the kitchen. A third lead pipe connected this pump to the attic tank that supplied water to the upstairs bath room. A forty-gallon copper boiler and a water back provided hot water for the kitchen sinks and the bath room.42

For the upstairs water closet, Woodward recommended "a best constructed pan closet, with white marble pattern basin, Wedgewood [sic] ware, enameled receiver and silver plated cup and handle." A separate cistern, twenty-four by fourteen by fourteen-inches, serviced the closet. The two water closets located on the first floor, however, were probably nothing more than wooden seats perched atop an eight foot deep brick-lined vault that was flushed with overflow water from the attic cistern: a 3 1/2-inch lead overflow pipe ran from the attic down to a point where it joined with a four-inch cast iron soil pipe from the upper water closet, and then continued down into the first floor water closets' vault. An earthen drain pipe carried these wastes from the vault to a cesspool.43
Fig. 2.7 The ground floor plans for George E. Woodward’s Design No. 1, as shown in his 1869 National Architect
The Diverse Meanings of Convenience

These examples demonstrate the lack of uniformity in mid-nineteenth century water fixture installations. Plumbing users lived in small cities and large, in "suburbs" and villages, on farms and "country estates." They all embraced the notion of domestic improvement, but the kind and quality of material reform implemented varied from house to house. Moreover, Americans perceived domestic reform as a project with individual roots: personal desire for change, rather than national, state, or local policies and mandates, propelled the task of domestic improvement. As a result, diversity rather than uniformity marked the technology and installation of mid-century plumbing. Beecher and Allen, for example, maximized convenience by putting water fixtures on one floor, and by using non-mechanical privies. Bickford, on the other hand, weighed the disadvantages of second and third story water tanks and fixtures against the advantages of "running" water and a bathing room adjacent to the bedrooms, and decided in favor of the latter. The Bickford and Woodward houses used a pump and an elevated cistern to replicate the water supply convenience enjoyed by city dweller Rogers, who had access to the Cochituate water works. Woodward and Rogers opted to use mechanical water closets, despite the disadvantages these devices posed in terms of breakdowns and cost; the Woodward house, however, combined the best of both worlds by also using two non-flush privy-type closets. In each case, the designer or owner created plumbing installations that reflected individual wants and needs; the owners' desires, opinions, and income determined the limits of convenience. These examples also reiterate a claim made earlier: the appearance of mid-century plumbing did not depend on a "technology system," such as a water works,
without which "it would have been useless to devote a room exclusively to the bath." Similarly, the use of mechanical water closets was not "necessarily limited" to "cities which had a steady water supply." In other words, a particular set of ideas about domestic life, rather than an innovation in technology, spurred the appearance and use of household plumbing.

**The Costs of Convenience**

For those who participated in the domestic reform effort, the potential for achieving the domestic ideal and fulfilling the desire for convenience ran aground only when ideal and desire collided with the cost of convenience. Cost may have been a significant determinant in the decision to purchase the convenience, but it was a determinant of immense flexibility, in no small measure because of the lack of plumbing codes, which would have required consumers to spend the minimum necessary to "meet code." Instead, no two installations looked the same, and both the quality and quantity of water fixtures varied widely from house to house. Subsequent chapters will discuss the prices of specific fixtures in greater detail, but now it may be useful to look at both the actual and the hidden costs associated with water fixtures.

**The Price of Fixtures**

In the late nineteenth century, one New York plumber recalled that during the 1840s plumbing work for "an average house" cost six hundred dollars, but that found in "a very fine house" cost closer to two thousand dollars. The (probably) "very fine" houses of Henry Parish and Trevor W. Parke demonstrate one extreme on the continuum of convenience: Parish's Manhattan house, built in the 1840s, had seven water
closets, eleven bathing tubs, and numerous wash basins. When Parke built his North Bennington, Vermont, home in the mid-1860s, the contractor installed twenty-five hundred dollars worth of plumbing, including five bath tubs, one hip bath, five Bartholomew valve water closets, and fourteen wash basins, as well as a copper boiler, wash trays, and a copper butler’s sink. The H. B. Rogers house described earlier represented a more constrained interpretation of “convenience”: Rogers paid close to four hundred dollars for fixtures and labor. He spent seventy-five dollars for new water closets and tubs, and forty dollars for two kitchen sinks and two marble basin slabs. For “plumber work” Rogers paid $266.00, although it is unclear if that figure represented the total cost of labor, or just the cost of installing the fixtures mentioned above, since workers also installed a boiler, several sinks, and a great deal of pipe.

A plan book published in the late 1850s included plumbing and water supply estimates for a house equipped with hot and cold water throughout, a full bathroom (water closet, basin, and tub), several cisterns, and numerous wash basins. The book’s author estimated the price for the bathing room, hot water system, and supply pipes at six hundred dollars, and the cost of pumps, a well, and the several cisterns at five hundred dollars. In his 1852 Model Architect Samuel Sloan calculated the plumbing costs for a ten thousand dollar two-story house. The fixtures, described as “of the very best quality,” with prices “set at the market cash price,” included an enamelled iron tub and sink, hot and cold shower, a lead-lined attic tank, two water closets, and two wash basins. The tub and sink came to $29.50, and the brass shower added another $17.50 to the price. Sloan estimated the price of “China
bowls" for the chambers, presumably washbasin bowls, at three dollars each, and the two water closets at seventy-five dollars each, plus another $11.90 for their attached soil pipes. The total: $214.90, a figure that does not include the price of the attic tank or labor.51 Nor do any of these prices include two other costs that users of water fixtures faced: paying for "public" water, when it was available, and paying for both maintenance and for the damage that, by all accounts, water fixtures were likely to cause.

The Price of Water

Generally speaking, municipal water boards assessed their customers two different charges: an annual water "rent," typically based on the size of the house and/or the number of occupants, and a separate charge for each water fixture, a levy that hardly seems surprising considering the lack of uniformity among household installations, and the lack of reliable metering devices. Of fourteen cities for which water rates could be determined, all of them charged customers an extra fee for water fixtures although Brooklyn permitted each customer one free water closet or tub, charging two and three dollars, respectively, for each additional fixture. In 1849 water users in the Moyamensing district of Philadelphia paid anywhere from $2.50 to five dollars annually for water, depending on size of the house and its location. On top of that initial charge, customers paid three dollars for each bath tub and one dollar for each water closet.52 At the same time, the base rate for Boston water takers started at six dollars per house, depending on the assessed value of the structure and the number of families living in it: a family living in a house with an assessed tax rate of one thousand dollars paid six dollars, while one living in a dwelling with an assess-
ment of between eleven and twelve thousand dollars paid seventeen dollars annually. But regardless of the size of the house, each tub or water closet cost an additional five dollars per year.\textsuperscript{53}

These rates remained surprisingly stable over several decades, and sometimes even dropped. For example, in 1854 the Baltimore water board charged customers rates that started at six dollars per year, and three dollars for each w. c. or tub, but by 1871 those rates had all dropped by one dollar.\textsuperscript{54} The residents of Richmond, Virginia, paid the same water rates in 1867 that they had in 1859: an initial rent of five dollars and up, and an additional three dollars for each one-seat water closet. (They paid two dollars for closets with two or more seats.)\textsuperscript{55} In 1869 water takers in Peoria paid five dollars and up for water and two dollars for each tub or water closet, rates comparable to those paid in Moyamensing twenty years earlier.\textsuperscript{56} Water rents rose only slightly in Detroit over a fifteen year period: in 1860 rates started at three dollars, and customers paid from two to five dollars for each bath or water closet. By 1875 the base rate had risen to five dollars annually, and customers paid two dollars for tubs, twenty-five cents for each wash-basin, and three to five dollars for pan closets. The Detroit water board established rates on a case-by-case basis for customers who persisted in using the wasteful hopper-style water closet.\textsuperscript{57}

The Price of Imperfection

People who relied on private water avoided these expenses, of course, but all plumbing users faced the costs of maintenance and repair. All the available evidence indicates that mid-century plumbing could be a real domestic headache. Plumbing users struggled with everything from leaky faucets and tubs and temperamental water closets, to
frozen and cracked pipes and the damaged ceilings and drenched carpeting that they caused. According to one patent application, metal-lined tubs "frequently" leaked because manufacturers placed the seam on the bottom of the tub. Over time the seam gradually opened and the tub leaked because of the "loosening of the joints, caused by the springing of the sides of tub[, by] the shrinking of the wooden bottom, and also by the weight of the person when stepping into the tub."\textsuperscript{58} Washbasins, sinks, and faucets also caused problems because of the way plumbers attached them to the wall, and because mid-century faucets were notoriously leaky. Leaking faucets and loose joints caused moisture to build up in the space between the back of the fixture and the wall, so that "in houses where sinks and other vessels are fitted permanently in place, and warm and cold water supplied to the same, it is found that roaches and water bugs accumulate very fast around such articles."\textsuperscript{59} The practice of encasing sinks in wooden frames caused still more problems because, as one writer explained, "the shrinkage of the wood" created an "opening . . . between the metal sink and the wood-work, into and through which water splashes, . . . and from the moisture and drippings, the floor below is constantly saturated, and frequently rots."\textsuperscript{60} Earthenware basin bowls usually leaked at the point where the faucet came through the wall, or where the basin sat on the slab, causing "much annoyance, decay of walls and ceilings and destruction of property . . . ."\textsuperscript{61} Water closets caused similar problems: closet valves and pipe joints tended to leak, producing wet floors and ceilings, as well as obnoxious odors, and water closets' complicated mechanisms kept plumbers busy with repairs.\textsuperscript{62} Home owners and plumbers tried to prevent the inevitable water damage caused by faulty devices by lining the floor
under closets, tubs, and sinks with lead safes, but that practice did little to alleviate the biggest headache plumbing users faced, namely frozen and cracked pipes. This problem occurred because for much of the mid-century period, Americans alleviated water closet odors by placing these fixtures adjacent to an outside wall. Then, in order to conserve space and economize on installation costs, they stacked all the other fixtures and pipes above and below the water closet, a practice that guaranteed that all of the household’s pipes and fixtures met the same fate in cold temperatures.

An anecdotal description in an 1868 essay by Philadelphia plumber W. G. Rhoads illustrates the problems associated with water pipe placement and installation. Rhoads invited his readers to examine a comfortable house “pleasantly located near the centre of Philadelphia” whose inhabitants enjoyed the convenience of a second-floor bath tub and water closet. “Mr. Jones,” the owner, lamented that, alas, the family could only use the fixtures in the summer. “How so?,” inquired Rhoads. Jones explained that although he had insulated the pipes with sawdust “by the cart-load,” the installation of the pipes and fixtures conspired against his efforts.

The bath-room is frame, you see, projecting from the brick building; and the pipe runs up on one of the posts supporting it, where it is exposed to the weather; the hot-water pipe is also exposed, where it comes through the wall of the kitchen, to enter the bath-room. Then, the trap of the water-closet is in the floor; and, of course, freezes and bursts, the first cold weather; and, just when we begin to feel the advantage of having it in the house, we are obliged to abandon it for the winter. After patiently paying the plumber’s bills, for mending leaks and thawing pipes, we turn off the water in despair, and close the entire arrangement until spring.63

Rhoads assured his readers that new house designs eliminated the problems of freezing and leaking because “the parts of the house which con-
tain the water-fixtures are mostly in the central portions of the building," but he urged persons living in older houses to protect their investments by learning how to insulate, thaw, and repair pipes, and by knowing the exact location of the shut-off valve. As a Poughkeepsie plumber put it, if people "wish[ed] to have use of [their fixtures] in winter," it behooved them to learn some simple survival strategies. Advice included installing plumbing only on the south side of the structure, insulating pipes with boards and sawdust, running pipes near or actually in a chimney flue, covering pipes with layers of "felting, such as steam fitters use on steam pipes," and either shutting water off at the main or leaving taps running on cold nights.64

The Limits and Intentions of Municipal Regulation

Plumbing users employed these tactics as a way to temper the limitations of water technologies and installation methods inside the home. Outside the house, municipal governments regulated household drainage practice and the use of water fixtures as a way to mitigate the impact of plumbing on expensive public utilities and to prevent plumbing users from creating health hazards in the form of improperly disposed wastes and pools of standing water. Municipal interference in domestic sanitation practice was hardly new in the middle decades. For most of the century municipal governments prohibited people from dumping wastes on streets and other public property, and passed ordinances that governed the use of privies on private property. For example, cities required people to keep privies in good order, and dictated where and when households could empty privy vaults, and even how and where those vaults were to be dug.65 These ordinances accomplished several ends. Because cholera and other epidemic diseases most often appeared during
warm weather months, prohibitions against summer vault cleaning mini-
mized the likelihood of creating or contributing to the miasmas associ-
ated with disease. City officials required property owners to dig
vaults of a certain depth and to line them with stone in order to
prevent the contents from seeping into and soaking the ground (which
contributed to the formation of miasmas) and from contaminating wells
and cisterns. Some cities ordered residents to attach their privy
vaults to a drain, a requirement that encouraged careful waste removal
practice. Ordinances of this type regulated privies, but cities used
water works and sewer ordinances as tools with which to regulate the use
of water fixtures and running water.

**Water Works Ordinances**

When a municipality constructed a water works, typically the
city council passed governing ordinances that spelled out the relation-
ship between the works and its customers. The regulations passed in
Philadelphia, a city generally regarded as having the first important
municipal American water works, typify those used in the United States
until after the Civil War. In that city municipal statutes admonished
water takers against waste and theft, prohibited the re-sale of water
for a profit, and empowered works employees to enter customers' premises
in order to determine the cause of "any unnecessary waste of water."
Ordinances mandated that pipes carrying water from public mains to pri-
vate supply pipes be "of sufficient strength" and required customers to
have an accessible stop-cock so that works employees could shut off the
water when necessary. In 1854 the city passed an ordinance that author-
ized water "inspectors" to enter premises in order to take "an account
of all connections and openings on the premises and their uses, such as
the number of hydrants, baths, water closets, fountains, &c."

Other cities followed Philadelphia's example. The 1850 Boston water works ordinance required customers to "prevent all unnecessary waste of water," to keep service pipes "in good repair, and protected from frost," and authorized the water registrar to enter takers' premises in order to "examine the quantity [of water] used, and the manner of use," presumably so that the Cochituate Water Board could monitor waste and calculate the number of fixtures in use. In Richmond, Virginia, the 1859 water ordinance included similar stipulations against waste and required all potential customers to submit a written description of the purposes for which water was wanted and "a plan of the work intended to be done" to the water superintendent. The ordinance insisted that "practical and competent plumbers" make pipe connections and install fixtures using materials of "the best quality and sufficiently strong to withstand double the required pressure." The Hartford, Connecticut, ordinance in force in the early 1860s contained virtually identical clauses, although that city required plumbers rather than customers to report the numbers and type of fixtures installed to the water registrar. The Hartford law also prohibited people from using "continuous flow" as a way "to guard against frost" and charged the city's police force with the task of monitoring and investigating any "unnecessary profusion of flow and waste." Chicago's water ordinance in force in the mid-1860s ordered customers to keep their "service pipes, stop-cocks and apparatus in good repair, and protected from frost," and to keep "taps at wash-basins, water-closets, baths and urinals" closed except when in use. In an 1869 ordinance, the Peoria, Illinois, water board protected its water supply by requiring plumbers
to use pipe "of the kind known as 'strong' lead" of at least one half-inch in diameter. These water ordinances are significant for what they did not do: none of them required residents to connect their houses to the water mains, and none forbid the continued use of privies, in-house water reservoirs, backyard wells, or cisterns. Moreover, aside from some general stipulations, none demanded that customers install or use specific types or quantities of water fixtures. The Richmond ordinance cited above insisted that residents employ "practical and competent plumbers," and use materials of "the best quality," but those stipulations hardly constituted a plumbing code; rather, residents remained free to make broad choices about plumbing installation and use. In other words, even when people had access to a public water supply, it did not matter where they got their water, how they stored it, or what they did with it, so long as they didn't waste it, steal it, give it away, or dispose of it improperly in a public space.

Instead, water works ordinances served primarily as mechanisms with which to prevent waste and health hazards, which is another way of saying that cities used water works ordinances not as a way to monitor plumbing itself, but as tools with which to protect an expensive public works from damage that plumbing might cause to that works, to protect others from any standing water or foul wastes that plumbing users might generate, and to prevent unnecessary leakage and waste of costly pumped water. The 1869 Peoria plumbers' ordinance mentioned earlier is a good example of both. When Peoria voters approved plans to construct a works, city officials first purchased pumping equipment from the Holly Manufacturing Company, including two Holly rotary pumps; later, however,
the city added Worthington high pressure pumps. Once the city had installed the Worthington pumps, plumbing users had to install their pipes and water fixtures in a way that enabled the fixtures to withstand the pressure. City officials passed an ordinance that stipulated minimum weight standards for both the external lead pipes (those that connected the house to the main), and internal lead service pipes (those used inside the house). (The ordinance set no standards for iron pipes, presumably because iron pipes could withstand the water pressure.) Water customers had to use "stop-cocks and other appurtenances" "sufficiently strong to resist the pressure and ram of the water." The city also monitored plumbing installations by requiring all local plumbers to obtain a license, and to submit a full application for "each and every opening required" that stated "the size of the tap required, the size and kind of service-pipe to be used, . . . the purpose or purposes for which the water is to be used, and all other particulars pertaining to a full understanding of the subject." Regulations of this type protected the property belonging to the works, but they also ensured that plumbing owners used pipes and pipe connections that would not leak and thereby waste the city's water or cause standing water or pools of foul wastes. But this otherwise detailed ordinance said nothing about the fixtures themselves, or how people installed and used them.74

Sewer and Drain Ordinances

Municipalities also passed ordinances designed to monitor the private use of public sewers and drains, and, as in the case of water statutes, they used these ordinances to protect an expensive public investment. Mid-century Americans used drains and sewers in a manner that differed radically from the practice of the latter part of the
century. In the last two decades of the century, municipalities built citywide unified sewer systems that carried both wastes and storm run-off to a central depository. Prior to that time, however, Americans constructed drainage trenches primarily to drain low-lying or wet ground, rather than as conduits for carrying away household and industrial wastes: whether above or below ground, whether open trenches or buried pipes, these projects drained standing water and carried rain and snow run-off from populated areas. A mid-century drain solved a particular, rather than a general, problem; as a result, urbanites built an amalgam of public and private drains, troughs, and underground channels, rather than large-scale, unified sewer systems. Historians have faulted mid-century drainage practice as primitive and inadequate, but in fact it represented a rational response to a set of beliefs. For much of the nineteenth century Americans embraced the so-called miasmatic theory of disease. According to this view, damp earth, stagnant water, and putrefied or decayed animal and vegetable matter released noxious and toxic fumes, which in turn contaminated the atmosphere and generated disease. Thus scattered small-scale drainage works served an important function: they removed pockets of water and ground moisture that would otherwise stagnate and produce miasmas.

Americans recognized, and struggled with, the limits of their drainage practice and its technologies. An 1857 Springfield, Illinois, ordinance specifically forbid certain uses of the public lines: section eleven ordered that "no privy or cesspool . . . be drained or emptied into any public sewer," under pain of a fifty dollar fine. Until the mid-1840s New Yorkers faced a similar prohibition. A municipal statute expressly forbid New Yorkers from using public drains and sewers "for
the purpose of carrying off the contents of any privy or water closet. . . ."

With the advent of Croton water service, however, some council officials started a drive to permit residents to drain closets and privies into sewers. This effort succeeded in 1845, but the new law required persons using the drains to "have a sufficiency of Croton water, to be so applied as to properly carry off such matters". A Philadelphia ordinance passed in 1855 granted residents permission to "make openings into the common sewers." Philadelphians interpreted this act in the broadest terms possible and began connecting their privy vaults, water closets, and cesspools to the sewers. The Board of Health urged the City Council to end the "abuse of the privilege thus granted," arguing that "the system of connecting cesspools and privies with sewers, [was] one of the most reprehensible allowed by law." Board members argued, unsuccessfully, that since the sewers were not designed to hold wastes—there was not enough water to flush thoroughly the lines—the practice of connecting household drainage systems to the sewers only invited a new health hazard into the community. The Washington, D. C. Board of Health made a similar plea after the 1857 outbreak of the so-called National Hotel Disease. After an investigation into the incident, the Board concluded that the disease resulted from blood poisoning produced by inhalations of miasma. The source of the miasma? Gases from a faulty sewer connection, probably caused by built-up and stagnating wastes. The Board recommended that Council prohibit the connection of privies to the sewers.

These examples demonstrate the limits of sewer and drain technologies, limits that also shaped the ordinances that governed their use. Generally speaking, local statutes allowed residents to channel
their cellar and yard runoff into public drains, but required them to obtain a permit before doing so; typical ordinances also ordered local officials to supervise the work, and often dictated the manner in which the work was to be performed. Beyond this, however, sewer ordinances varied in specificity. During the 1840s and 1850s, for example, a Detroit ordinance permitted residents to make connections with public sewers, but by the mid-1860s the city had amended the ordinance to enable the Committee on Health to require connections between private lots and public sewers whenever that body deemed it necessary. Similar situations prevailed in the 1840s through the 1860s in such cities as Portland, Maine, and Manchester, New Hampshire, as well as in Lowell and New Bedford, Massachusetts. In Boston, city officials also reserved the right to require owners of property adjacent to common sewers "to make a sufficient drain" from houses, yards, and lots whenever they deemed it necessary, and authorized the "superintendent of sewers" to construct "sufficient passage ways or conduits under ground" for the purpose of draining privy vaults. The city's health ordinance also ordered all "waste water [to] be conveyed through sufficient drains under ground, to a common sewer," or to a "reservoir, sunk under ground" that had been approved by the same superintendent. In Boston, as in other cities, local officials expected residents to dispose of wastes properly, but offered few guidelines as to how that should be done; and, as in other cities, the Boston statutes neither prohibited nor required the use of specific waste fixtures or cesspools. In Chicago, city taxpayers and municipal officials built an atypical drainage system, one designed to hold both household wastes and storm water. The city permitted persons to drain water closets and ces-
spools into public mains, but it did not require them to do so. In other words, even though the technology had been designed for both drainage and waste disposal, and Chicagoans had the right to use sewers for wastes of all type, the city did not require them to do so, nor did it prohibit the continued use of privies and cesspools.86

The mid-century pattern is clear: local officials often required connections in cases where yards and lots did not drain thoroughly or properly, but few cities permitted residents to connect plumbing fixtures, cesspools, and privies to available public drains, for the simple reason that these conduits seldom contained sufficient water to push wastes on through to a terminus. In other words, Americans treated the disposal of household wastes as a private function, and as a result they did not build drainage facilities with waste disposal in mind. It is hardly surprising, then, that even in cities where existing plumbing fixtures numbered in the thousands, residents made little effort to regulate the use of those fixtures. But water ordinances also stopped short of imposing rigid restrictions upon plumbing users: they seldom dictated how people should install or use water fixtures, what kind of fixtures they should use, or how they should attach their interior (private) pipes to the public pipes outside the house. At mid-century Americans did not conceive of sewers and water works as a single unified sanitation entity; instead, they used sewers to drain swampy land and as conduits to collect and channel storm runoff, and "public" water as a tool with which to fight fires and clean streets. Many cities also provided water supplies in cisterns and wells for citizens' use, but very few municipalities regarded it as a governmental responsibility to pipe water directly into homes. Put
another way, mid-century ordinances left citizens free to construct private self-contained household sanitation systems. Even if Americans had used water fixtures in larger numbers than they did, plumbing codes probably would not have appeared at this time: people found little to fear from plumbing, and their perception of it as a tool of convenience—and reform as a matter of self-improvement rather than public policy—meant there was little pressure, legal or social, to require all houses to have this technology.

Plumbing Technology and the Idea of Convenience

This analysis of the mid-century relationship between water-based technologies, municipal regulation, and the concept of convenience reinforces a point made earlier: Americans treated mechanical water closets, attic cisterns, washbasins, and tubs as conveniences used by a few, rather than as tools with which to achieve a universal sanitary standard. Indeed, mid-century commentators rarely treated water fixtures and running water as tools of health, hygiene, or sanitation, except insofar as they eliminated health-sapping labor. No doubt Americans recognized the potential health benefits of water fixtures, but they clearly did not believe that running water and a full component of water fixtures ought to be included in every house. Instead, contemporary observers typically stressed the categorical and limited uses of plumbing's health benefits. Writing in the mid-1840s one writer opined that the "domestic bathing room [was] a matter of luxury, which few families can afford," and one that he did "not expect to see . . . adopted, in the majority or even in a great minority" of American houses.87 A decade later one housekeeping manual urged the installation of bathing rooms only "as often and as much as the budget will let."88
A physician discussing the importance of public water supplies for cleanliness and health argued that it was "not necessary" to "put water in every house" as long as it could be "place[d] . . . near to the hand of every person," such as in a public hydrant in the street.®

In the middle decades of the century, a desire for convenience prompted the appearance of household plumbing, and the limits of convenience determined its form and use in the American home. This chapter has discussed the factors that imposed those limits: the American propensity for classification and categorization, the limited appeal of domestic reform, the monetary costs of plumbing, and the technology itself. These factors combined to impose a kind of natural limit on plumbing's growth, without which the use of plumbing in the home could have created chaos outside the house: in theory at any rate, too many water closets, too many washbasins, attic tanks, and cesspools could have rendered cities awash with polluted wastes. Late-century complaints about just that problem and the appearance of plumbing codes at the end of the nineteenth century indicate that by that time American attitudes toward plumbing had undergone a dramatic shift. But between 1840 and 1870 a particular set of ideas about domesticity and national progress combined both to shape and constrain the use of water fixtures and running water.
Endnotes


2For two provocative, but quite different discussions of this phenomenon contrast Stuart Blumin, The Emergence of the Middle Class: Social Experience in the American City, 1760-1900 (Cambridge: Cambridge University Press, 1989), esp. 230-57, with Alan I Marcus, Plague of Strangers: Social Groups and the Origins of City Services in Cincinnati, 1819-1870 (Columbus, Ohio: Ohio State University Press, 1991), esp. 38-39 and 72-73. Marcus argued that the American passion for categorization emerged beginning in the late 1830s as a result of a shift in “ideas of society’s nature,” in this case a “shift from the individual to the group.” (38, 40) Blumin, on the other hand, argued that in the antebellum decades “social definition” became easier because of what he called the increasing “bifurcation” of American society, a process created by and enhanced by a “realignment of work, workplace relations, incomes, and opportunities.” (191)

3The health and urban reformers sometimes posited that larger water supplies would help alleviate the urban crisis, as noted in Chapter One. But providing public water with which to flush streets, and public hydrants for the use of the poor was quite a different matter from constructing in-house running water systems of the type that supported water fixtures.


Vaux, _Villas and Cottages_, 109, 119, 135, passim.

Wheeler, _Homes for the People_, 1, 24, 302, 321, passim.


Lewis Allen, _Rural Architecture: Being a Complete Description of Farmhouses, Cottages and Outbuildings . . ._ (New York: C. M. Saxton, 1852), ix, 17.

Cleaveland, et al., _Village and Farm Cottages_, iii. Often, of course, members of the "working class" would not be able to buy a home, especially those living in the nation's large cities. Thus it is not at all surprising, given the contemporary interest in both categorization and in homes, that the 1840s and 1850s saw the first national interest in creating adequate living spaces for "the working classes." Contemporary journals are filled with articles on the subject, and most plan books contained a few homes for this class. James Ford's 1936 investigation of "slums" still provides one of the best sources of information about the mid-nineteenth century interest in one solution to the problem, the tenement. See James Ford, _Slums and Housing with Special Reference to New York City: History, Conditions, Policy_, 2 vols. (Cambridge: Harvard University Press, 1936), 1:102–40. But a full understanding of the housing "problem" is not possible without a reading of Elizabeth Blackmar's superb study of early nineteenth century rental and housing patterns in New York City. See Elizabeth Blackmar, _Manhattan for Rent, 1785–1850_ (Ithaca, N. Y.: Cornell University Press, 1989), 183–212. Our understanding of contemporary perceptions of the problem will likely be enhanced by Henry Binford's current research into the changing ways in which Americans have defined the slum. Also see

14 Blumin, *Emergence of the Middle Class*, 121.

15 Ibid., 84.

16 Ibid., 68-98.

17 Ibid., 83-107.

18 The best discussion of this is in Katherine C. Grier, *Culture and Comfort: People, Parlors, and Upholstery, 1850-1930* (Rochester, N. Y.: The Strong Museum, 1988), esp. 19-28, but also see Blumin, *Emergence of the Middle Class*, 100-07.

19 Contemporary architectural manuals document the emergence of this new type of building, one devoted specifically to retail and clerical activities, rather than to the production processes associated with those types of enterprises; plans show that these buildings often had plumbing systems, a feature that quite likely influenced the white collar employees who spent their days there. For example, in an 1859 collection of building and house plans, Samuel Sloan included a design for a "private banking house" with seven "self-acting" water closets, each "fitted up with wash-rooms adjoining." The wash-rooms housed washbasins with china bowls, marble slabs, and "plated fixtures." Samuel Sloan, *City and Suburban Architecture; Containing Numerous Designs and Details for Public Edifices, Private Residences, and Mercantile Buildings* (Philadelphia: J. B. Lippincott and Co., 1859), Plate 3; Design 3; also see Design 1, Plate 13 and Design 21, Plate 103. For other examples see Marcus, F. Cummings and Charles Crosby Miller, *Modern American Architecture. Designs and Plans for Villas, Farm-houses, Cottages, City Residences, Churches, School-Houses, &c., &c.* (Troy, New York: by the authors, 1868), Plate 44; G. B. Croff, *Progressive American Architecture, Presenting in Illustration an Extensive Collection of Original Studies for Dwellings, Bank, School, and Office Buildings, Costing From One Thousand to One Hundred Thousand Dollars, Also Details of Every Feature, Exterior and Interior of Every Character and Class, for Town and Country Buildings* (New York: Orange Judd, 1875), Plate 9 and Plate 77.

20 For hotels see Jefferson Williamson, *The American Hotel: An Anecdotal History* (New York: Alfred A. Knopf, 1930); for amenities in general see pp. 39-72, and for plumbing in particular see 55-62. One of the earliest hotels with extensive plumbing was Boston's Tremont House; a description of its water supply and plumbing system is in William Harvard Eliot, *Description of Tremont House, with Architectural Illustrations* (Boston: Gray and Bown, 1830), 13-16. An excellent discussion of hotels as emblematic of middle class material aspirations and domesticity is in Grier, *Culture and Comfort*, 28-38. For good discussions of hotel living see Edgar W. Martin, *The Standard of Living in

21See the discussion in Grier, Culture and Comfort, 38-58. Plumbing for ships and boats was especially important in the first half of the nineteenth century, as evidenced by the patents devoted to ships' water closets. One "old plumber" reported that ship plumbing was an extensive and lucrative business in early nineteenth century New York, and one in which many plumbers got their start. See Felix, "A Talk with An Old Plumber," Sanitary Engineer 4 (1881-82): 498.

22Blumin, Emergence of the Middle Class, 238.

23Ibid., 189. The best discussions of domestic material life, especially for comparison of consumption behavior of the middle and working classes, are in ibid., 138-63; Martin, Standard of Living, 83-123; and Grier, Culture and Comfort, esp. 3-17; but also see Wright, Building the Dream, 77-78; Richard B. Stott, Workers in the Metropolis: Class, Ethnicity, and Youth in Antebellum New York City (Ithaca, N.Y.: Cornell University Press, 1990), 168-74.


26Ibid., 14.

27The skilled workers, employed as "skilled mill operatives and skilled boot, shoe, and leather workers," as well as in the "building, shop, and metal-working trades," earned from $561 to $795. But their earnings were topped by another category in the study, "factory 'over-seers,'" who earned, on average, $985 annually. See Ibid., 14.

28An assessment of other studies, as well as Blumin's conclusions, are in Blumin, Emergence of the Middle Class, 109-10.

29Ibid., 112-14, passim.


(Philadelphia: E. S. Jones and Co., [1852]), 1: Designs 1 and 9, passim, 2: Designs 30 and 34.

33Sloan, Homestead Architecture, 149, 217, passim.


36These examples are in Cummings and Miller, Modern American Architecture, text for Plate 19 and text for Plate 40; Sloan, City and Suburban Architecture, Design 19, Plate 90.

37A later section of this chapter discusses the regulations imposed on conveniences, but the lack of mid-century plumbing codes implies that the Americans who used water fixtures, who were also the same kinds of people who might be expected to sit on city councils, regarded themselves as responsible users. They needed housekeeping and other advice manuals to learn how to use water fixtures, but beyond that basic instruction they were intelligent enough to use fixtures without some type of external oversight.


39Allen, Rural Architecture, 122.


43Ibid., 10–15. For other published examples of plumbing configurations used in houses actually built see: John Hall, A Series of Select and Original Modern Designs for Dwelling Houses, for the Use of Carpenters and Builders, 2d ed. (Baltimore: John Murphy, 1840), 18; Sloan, Model Architect, 1:52, 2:97; Woodward and Thompson, Woodward’s
National Architect, Specifications for Design No. 6, pp. 1-4 and 8-9; Atwood, Country and Suburban Homes, 217, 222-23, 235-37.


45 Martin, Standard of Living, 90.

46 Felix, "Talk With An Old Plumber," 525. Prices of specific fixtures are discussed in a later chapter. A good way to examine prices throughout the period is by comparing two virtually identical price books, one published in 1833, the other in 1855. In 1833 James Gallier published a "price book and estimator," which includes prices for a variety of plumbing items including pumps, pipes, water closets, and bath tubs. In 1855 a New York architect, A. Bryant Clough, reissued Gallier's text under his own name, with only minor changes to Gallier's original text. Taken as a whole, these two books indicate that the costs of plumbing parts changed relatively little over the twenty-two year period. Costs for some things, like pipe and traps, rose a few cents, while prices for larger items like bathing tubs and water closets actually decreased. Interestingly, one of the biggest price hikes was for the price of labor: Gallier lists a plumber's cost at two dollars a day, and labor (presumably unskilled help) at $1.00 to $1.25 a day. Clough listed the same items at $3.50 and $1.25 to $1.75 per day, respectively. See James Gallier, The American Builder's General Price Book and Estimator (New York: Stanley and Co., 1833), and A. Bryant Clough, The Contractor's Manual and Builder's Price-Book (New York: Stephen Hallet, 1855).


48 Photocopy of building statements for Trevor W. Parke house. I am grateful to Anne Grady of the Society for the Preservation of New England Antiquities for sharing this document with me.

49 Contract and Specifications, H. B. Rogers house.

50 Hammond, Farmer's and Mechanic's Practical Architect, 121. Although many of the architectural plan books included price estimates, it is all but impossible to determine if those prices were for material or whether the writers intended them to include labor. If the actual finished cost of a house is known, one way to determine the costs of labor and material is by using the formula suggested by Donald R. Adams, Jr. in his essay on nineteenth century residential construction costs. He suggests that "cost structure," the proportion of cost devoted to material and to labor has changed little since the early nineteenth century. According to him, "direct labor costs (including overhead and profit)" accounts for about 52 percent of the total, and materials about 47 percent. In the late 1850s he estimates that plumbing-related labor accounted for 9 percent of the total construction cost, so that if the actual construction costs of a mid-nineteenth century house with plumbing are known, the plumbing labor should come to about nine percent of

51 Sloan, *Model Architect*, 1:44. The water closet prices seem odd, since seventy-five dollars is higher than any prices quoted in the catalogs available for this study, or for any other figures found in estimates. That figure either included labor, or Sloan was describing a costly imported porcelain or earthenware fixture.


54 City of Baltimore, Baltimore Water Commission, *Report of the Commissioners Appointed By Authority of the Mayor and City Council to Examine the Sources From Which a Supply of Pure Water May be Obtained for the City of Baltimore* (Baltimore: James Lucas, 1854), 17; City of Baltimore, Water Department, *Report of the Water Department to the Mayor and City Council of Baltimore, for the Year Ending 1870* (Baltimore: Kelly, Piet and Co., 1871), 28.


57 City of Detroit, Board of Water Commissioners, *Annual Report of the Board of Water Commissioners to the Common Council of the City of Detroit; Together With the Reports of the Superintendent and Engineer, and Secretary, For the Year Ending December 31, 1859* (Detroit: Free Press Book and Job Printing House, 1860), 66; Twenty-fifth Annual Report of the Board of Water Commissioners to the Common Council of the City of Detroit Together With the Reports of the Officers of the Board for the Year 1876 (Detroit: J. F. Hadger, 1877), 47.


59 U. S. Patent 27,545, James Ingram, "Fitting Sinks," 20 March 1860. Calvert Vaux recommended solving the bug problem by encasing all
pipe work in a metal "envelope." Vaux, Villas and Cottages, 161.


63Rhoads, "Plumbing," 331.


For other discussions of the problems plumbing users faced see McAvoy, Instructions on Plumbing, 3-11; Mulrein, Facts and Hints in Regard to Plumbing, 22-23; W. L. D. O'Grady, Hints to Plumbers and Householders (New York: The American News Co., 1878), esp. 27-31; G. S. Davenport, Plumbing Practically Considered. Sanitary Hints and Suggestions (Providence, R. I.: by the author, 1881), 7 and 29, passim; Thomas Read, Interesting Facts About Plumbing ([Brooklyn]: n. p., 1883), 9-16.

65Dozens of municipal ordinances were surveyed for this study. For representative examples see City of Covington, Kentucky, "An Ordinance to abate Nuisances in City of Covington," Charter of the City of Covington, and Amendments Thereto Up to the Year 1864, and Ordinances of Said City, and Amendments Up to the Same Date (Covington, Ky.: n. p., 1864), 11; City of Macon, Ga., "Nuisances," Charter and Ordinances of the City of Macon (Macon: Georgia Telegraph Office, 1853), 37; City of Cincinnati, "An Ordinance for the prevention of nuisances in the city of Cincinnati," Charter, Amendments, and General Ordinances, of the City of Cincinnati (Cincinnati: Day and Co., 1850), 317; City of Hannibal, Mo., "An Ordinance in Relation to Nuisances," The Revised Ordinances of the City of Hannibal, Revised and Digested in the Year 1858, by the City Council . . . (Hannibal: William T. League and Co., 1858), 145; City of Burlington, Ia., "Nuisances," Ordinances of the City of Burlington, Chas. Ben. Darwin, rev. (Burlington: Thompson and Co., 1856), 101; City of Boston, "Health. Ordinance of the City," Charter and Ordinances (1850), 203; City of Columbus, Ohio, "Nuisances. For the Prevention and Removal of Nuisances, in the City of Columbus," Statutes for the Organ-


For other cities see City of Lawrence, Kans., "Ordinance No. 2," Charter and Ordinances of the City of Lawrence, Together With An Act Amending the Charter, Passed by the Legislature of 1858 (Lawrence, Kans.: Republican Book and Job Office, 1858), 7; City of Springfield, Ill., "Nuisances," The Revised Ordinances of the City of Springfield, Revised and Registered by the City Council, in the Year 1851, John Calhoun, rev., (Springfield: Illinois Organ Office, 1851), 115; City of


Boston, Charter and Ordinances (1850), 429.

City of Richmond, "Water Works," Charters and Ordinances (1859), 132-44.

City of Hartford, Conn., "Rules and Regulations Made By the Board of Water Commissioners of the City of Hartford, Under a Resolution of the General Assembly of the State, Passed May Session, 1861, Amending the Charter of the City of Hartford," (n.p., [1861]).

City of Chicago, "Water Works," Laws and Ordinances (1866), 360-63.


At least one exception stands out against this otherwise standard pattern of minimal regulation. The 1860 Brooklyn water works ordinance required the owners of "tenement houses" to "cause all proper and necessary water and sewerage fixtures (water-closets included) to be permanently placed in each and every story of such house, for the use of all the occupants thereof". This stipulation ensured that people living in multiple-family dwellings had access to a water faucet as well as drain pipes to carry wastes out of the building. How stringently the city enforced the law is not certain, but it seems clear that city officials intended to use the law to cope with the health hazards of over-


75 There were exceptions: during the 1850s Chicago, Brooklyn, and Jersey City built unified multi-purpose systems. Brief descriptions are in Jon A. Peterson, "The Impact of Sanitary Reform Upon American Urban Planning, 1840-1890," Journal of Social History 13 (1979): 87-88.


This view explains why cities often constructed open sewer and drain trenches: runoff exposed to the air and sun putrefied less quickly and evaporated faster than that trapped inside a pipe. Indeed, people often opposed the construction of underground or enclosed drains: during wet seasons water pushed accumulated matter, such as dead animals or illegally-disposed household leavings, on through the pipe, but during dry spells these wastes sat inside the pipe and putrefied, creating deadly miasmas. For instances of opposition to enclosed drains see Duffy, *Public Health in New York City*, 405-06, and Rhines, "A City and Its Social Problems," 282-83.


Morman argues that the Board resisted this plan because it feared that the use of water closets would spread to the lower classes; thus, says Morman, the episode signalled yet another way in which local health officials used sanitation measures as a form of social control.


83 City of Detroit, "Relative to public Drains and Sewers," Revised Charter and Ordinances (1848), 95-98; "Public and Private Drains and Sewers," The Revised Ordinances of the City of Detroit for the Year 1871, Revised and Published by Order of the Common Council (Detroit: Free Press Book and Job, 1871), 134.


87 Review of Human Health, by Robley Dunglison, American Journal of Medical Sciences n. s. 17 (1845): 390.


In the middle decades of the nineteenth century, the successful use of conveniences such as bathing tubs, water closets, and washbasins depended on the availability of an adequate supply of household running water as well as ready access to some sort of drainage and waste facility. Some people enjoyed the readymade running water provided by water works. But most Americans did not have that luxury. Instead, those who sought to improve domestic life combined a variety of technologies, such as cisterns and pumps, in order to create household systems that provided the convenience of running water. Similarly, people constructed self-contained private drainage systems in order to efficiently manage household wastes. This chapter examines the supply and drainage technologies employed by the mid-century household.

Public and Private Water Supplies

Between 1840 and 1870 some American municipalities boasted water works, defined here as a publicly- or privately-owned centrally-located works that distributed water to residents through mains and supply pipes, or open hydrants. Large works such as the Croton Aqueduct and Boston’s Cochituate system stand as testimony to the skill of mid-century engineers. But not every municipality or chartered water company built such enormous or elaborate works; instead, many cities and towns financed, constructed, and maintained public wells, or cisterns
fed by water piped from springs and rivers, or local entrepreneurs built small aqueduct systems that supplied water to a limited number of customers. According to Edgar Martin's study of mid-nineteenth century American living standards, cities such as Sandusky, Ohio, and Charleston, South Carolina, constructed wells and cisterns, while other municipalities relied on "an 'aqueduct' and a few water mains; . . . ." In Dedham, Massachusetts; Danbury, Connecticut; Burlington, New Jersey; Amherst, New Hampshire; and Reading, Pennsylvania, residents obtained water piped from local springs. In some places water sellers carted water through the streets to customers. Relatively simple arrangements such as these at least brought water into the general neighborhood, even if not into the house itself.

Determining the extent to which Americans relied on individual wells, cisterns, springs, or other private arrangements presents greater problems. It seems unlikely that every backyard had a well, especially in cities where population densities, groundwater pollution, and overbuilding discouraged the use of private wells by the middle of the century. However, in small cities and towns, where houses often sat on larger plots of land and population densities were low, household wells were probably commonplace. An 1852 essay published in the Transactions of the American Medical Association described several examples of private water supplies based on wells and pipes, such as a Lowell, Massachusetts, family that channeled well water through forty feet of lead pipe to the house, and a Waltham, Massachusetts, man who piped water from his backyard well to a kitchen pump. In Manchester, New Hampshire, one of the local factories supplied well water to workers living in company housing: one well fed ten households, through ten separate lead
pipes. Lead pipe also connected the well to the kitchen sink in the Sarah D. Bird house, built at Brookline, Massachusetts, in the late 1850s. Mid-century architectural plan books often assumed that a household would obtain water for fixtures from private wells. Mid-century Americans also obtained private water supplies from creeks, springs, brooks, and rivers. A western New Jersey man used one inch-lead pipe to channel water to his house from a spring one mile away. In Shelbyville, Tennessee, residents used water from springs as well as from wells and cisterns. When a New Hampshire man failed to find water on his own property, he laid wrought iron pipe from his house to a nearby river, where he built a penstock as a way to create a small fall, and then pumped the water to his house; eventually he expanded this private works so that it would supply the entire village. In the early 1800s a few households in Washington, D. C. banded together to construct a quasi-private water supply, piping water into their houses from a neighborhood spring; other families continued to rely on public wells and private cisterns. 

Rain and snow also provided household water. Both had the virtue of being relatively pure and "soft," essentially free, and, depending on the region, relatively abundant. One writer estimated that the roof of a twenty square foot house presented four hundred square feet of "plane surface" with which to capture water, or almost five thousand gallons each year. Such a supply, he and others argued, was too valuable to waste needlessly. To guarantee the water's purity, advice manuals suggested that builders construct the roof of a smooth material, and edge its perimeter with "leaders" that channeled the water to a storage tank. Most writers recommended using tin and slate,
although one writer urged people to use "plastic slate roofing," an asphalt-like, tar-based material that he described as "the cheapest, [and] the most durable . . . of any material that can be employed for covering buildings." Its only drawback, he noted, was that the coal tar used in its manufacture would initially "color the water, and injure it for culinary purposes." Tin served as the material of choice for fashioning the "leaders" that ran along the roof edge and carried the rain water off the roof. Builders used two methods to connect a leader to a storage tank. They simply ran the pipe down to a point just above the tank itself, or, if the storage vessel sat underground, ran the leader to an underground drain tile and then connected it with the cistern where the water was stored.

These examples demonstrate the diversity and scope of mid-century water supply arrangements. In some sense these water arrangements were hardly new or revolutionary. What was new at mid-century, however, was the intense interest in improving and perfecting water supply systems. The provision of water could be, and often was, a municipal responsibility, but those who sought to improve household water supplies, and thus their domestic environments, need not wait for public policy. Instead, people living in both town and country obtained advice from a host of manuals and magazines that acted as conduits of information about domestic betterment and promoters of national progress. Inventors contributed to the project by obtaining dozens of patents for improved methods of well and cistern construction. Americans then connected their water sources to a variety of technologies in order to increase water's utility, and the same guides that promoted improved water supplies provided would-be reformers with the
Cisterns proved to be especially important in mid-century household water systems. Mid-century magazines and books, especially those devoted to "country" homes and "rural" life, routinely published instructions for building underground cisterns, and the architectural plan books treated cisterns as common elements of a household water system. New York City real estate advertisements published in the 1820s and 1830s listed cisterns as part of the property, and in his 1845 essay on the "laboring classes," sanitary reformer John Griscom noted that, with the arrival of Croton water, New Yorkers had turned their cisterns into cesspools for waste storage. Americans living in smaller cities and towns, as well as rural areas also used them. In Washington, Texas, and Shelbyville, Tennessee, cisterns were "coming into general use" in the early 1850s, although in Shelbyville they had "been too recently installed" to determine whether the water stored therein was any healthier than the spring water used by most residents. In Covington, Kentucky, a city with "many springs of excellent limestone water" and "a few good wells," citizens stored household water in cisterns, but in the Charleston area, one writer lamented that on nearby Sullivan's Island cisterns were "scarce and valuable as diamonds from Golconda. Few of the houses have them, ... [and] a cistern is an exception to the general rule." Generally speaking, people used two types of cisterns: ones built outside the house, usually, but not always, underground, and ones installed inside the house, either in the cellar or in an attic (Fig.
A cellar cistern held water piped to it from the roof, an outside cistern, or a well, or it received the overflow from another interior cistern. An attached pump and pipe enabled household members to move the cistern's contents up out of the cellar and into other areas of the house. Exterior cisterns sometimes stood on legs above the ground, but more often people located them underground, near the house and connected to it by one or more pipes: tin leaders channeled rainwater from the roof to the tank, and one or more other pipes carried the water into the house. Some people made "prefabricated" cisterns by setting a large cask or barrel, from which one end had been removed, into a hole slightly larger than the barrel itself, filling in the space around the barrel with some sort of "mortar" or "hydraulic cement." More typically, however, people dug a large hole and lined it with brick, stone, or mortar, thus using the earth itself as the cistern. One writer advised that the most satisfactory way to make a large cistern of bricks, is to make a circular excavation, say twelve feet deep, and seven or eight feet in diameter. Carry up the wall perpendicularly, the width of one brick-or four inches-thick. Lay the bricks with care in water-lime cement. When within five feet of the surface of the ground, commence drawing the wall in . . . to such an extent that a stone, or plank, a yard square will cover the top. Cement the bottom and sides thoroughly with excellent cement mortar, and you will have a cistern that will never fail.

The size of these tanks obviously varied from household to household depending on need. In one of his plan books, William Ranlett included plans for a brick cistern ten feet deep and ten feet in diameter, which he claimed would hold 4800 gallons. In The Economic Cottage Builder, Charles Dwyer suggested a cistern seven feet deep with an eight foot diameter, while the rainwater cistern built at the Henry Bowen house in the late 1840s was seven feet in diameter and eight feet deep.
Fig. 3.1 A Troy, New York, house with a cellar cistern and other conveniences. From Bullock's American Cottage Builder
inexpensive cottage included in one of George Woodward's books had a ten foot diameter cistern at the back, a vessel Woodward claimed would hold six thousand gallons of water.\textsuperscript{24}

People purified cistern water intended for consumption by trapping impurities in filters made of layered gravel, sand, charcoal, and, sometimes, flannel.\textsuperscript{25} They installed such filters inside the cistern, or in a smaller separate vessel attached to the main cistern.\textsuperscript{26} In the case of the first type, the filter lay at the base of a divider wall that split the cistern's interior space in two. A supply pipe carried water in one side of the cistern, but the discharge pipe sat on the other side of the divider, so that the water ran through the filter before exiting. The disadvantage of this type of filter was that it could only be cleaned or replaced after all the water had been pumped out of the cistern. As a more practical alternative, then, people divided the two functions—supply and filter—between two different containers. Rainwater fell into a regular supply cistern, whose only outlet lay through a pipe that ran to a second adjacent cistern which contained both the filter and the discharge pipe. The pipe connecting the two vessels usually had a spigot, or cock, which allowed the user to shut off the water from the supply side when the filter needed to be replaced (Fig. 3.2).\textsuperscript{27}

Regardless of where it was located or how it was made, the cistern played an important part in household water systems. A cistern enabled any family, even one that did not have access to a water works, to store the large quantities of water necessary to operate water fixtures, and thereby duplicate, on a small private scale, the convenience of a large external water works. In other words, cisterns and private
Fig. 3.2 Typical cisterns, three with filtering devices
water sources functioned as tools that enabled American families to maximize their opportunities to create quality domestic environments.

Moving Water Into and Throughout the House

Water obtained from a variety of sources and stored in wells and cisterns served as the core of a domestic plumbing system, but the actual use of water fixtures inside the house depended on the solution to two other technological problems. First, once a supply had been located and acquired, it had to be moved from its source to the house itself. Second, the water had to move easily throughout the house, and into plumbing fixtures. These two problems are not necessarily related, and indeed, each requires a separate discussion if their final role in a functioning plumbing system is to be understood.

Pumping and Transfer Devices

The first problem, moving water from its source into or at least nearby the house, could be solved in a number of ways. A water supply located uphill from the house provided both supply and moving force in one; a homeowner only needed to lay pipe to carry it to the house. But when the supply came from a nearby but unelevated spring, a well, or a cistern, or from a water works which, lacking a steam pump, offered little in the way of pressure, moving it near to or inside the house posed a more serious problem. Magazines and advice manuals served as clearing houses for information about how to build or improve water transfer devices, but mid-century inventors also contributed to the effort by patenting hundreds of devices designed to simplify the chore of moving water up out of wells, cisterns, and springs, and to buildings and lots. For example, a Scotland, Pennsylvania, inventor obtained an
1849 patent for what he called a "telegraph water carrier," a contraption using telegraph-like poles and wires plus a pulley system to move buckets of water from one point to another. The inventor explained that his improvement enabled users to "surmount houses, or elevated portions of the ground, and to cross roads or streams lying between the house and well . . . ." An Aurora, Illinois, inventor obtained an 1860 patent for another "water elevator," this one using multiple buckets, a windlass, and weights. By manipulating the windlass, the user moved a full bucket up out of a well or other body of water. As the full bucket rose to the surface, an empty one began to descend. When the full bucket reached the top it automatically tipped into an adjacent conduit that carried the water away to where it was needed. This device, explained the patentee, was "designed for domestic use, and to facilitate the work, that females and children may draw the water without the least difficulty." These inventors, and hundreds of other like-minded souls, understood that water, of course, was only as convenient as it was accessible. Given the patent interest in devices like these, it seems possible that Americans all over the nation used any number of individual arrangements similar to those described above to transfer water to their houses. But mid-century Americans also used two other noteworthy devices to move water: the hydraulic ram and the simple hand pump.

The ram had several virtues: it had few working parts, so that, once set in motion, it needed little or no attention or maintenance (Fig 3.3). Moreover, the device pumped water uphill with little mechanical effort, no manual labor, and no complicated mechanism, so that with its
Fig. 3.3 A hydraulic ram

use "water [could] be thrown into every room in the dwelling house, as well into various buildings, and yards, and fields ... wherever it may be required." A ram had two valves, one a hinged flap valve and the other a spindle valve that bobbed freely in the water. The hinged valve stood between the main water pipe and an oval-shaped chamber. The discharge pipe, which carried water to the house, branched off from this chamber. As water entered the ram's main pipe it pushed the ball up against an outlet through which water would otherwise flow. As the ball closed the opening, the water stopped abruptly. The water's jolt pushed against the second valve and opened it; water poured through the opening, into the oval chamber, and out the discharge pipe. As the water poured out, its momentum gradually decreased and eventually the hinged valve snapped shut. For a brief moment, both valves were closed, the water stood motionless, and the ball valve dropped back down into
the water. This action created an opening into which water once again flowed. Once the water was in motion, it pushed the ball valve against the opening, its closing compressed the water, and forced open the hinged valve. The cycle began again.32

The ram proved particularly useful in rural or semi-rural settings where a household had access to a natural supply of water such as a spring or brook, as in the case of the Virginia "mansion" whose owner used a ram to pump water four hundred feet from a spring to his house; pipes then carried the water throughout the dwelling.33 But city dwellers also used the ram. For example, throughout the 1850s and 1860s Boston's Cochituate Water Board consistently listed hydraulic rams in its tabulation of water fixtures supplied by the Board, and a correspondent to The Country Gentleman noted that his Philadelphia household enjoyed running water in bathroom, water closet, and kitchen, thanks to a ram he installed in the late 1840s.34 But the ram may not have been as common used as other pumping devices: in 1850 a Philadelphia inventor claimed to have sold and installed about a thousand of the devices, but in 1852 Scientific American printed an essay describing the device on the front page, a space traditionally reserved for discussions of new inventions and patents. The editor justified his decision by claiming that an earlier article on the subject had prompted a large number of reader requests for more information, suggesting that the ram's use in the early 1850s may not have been widespread.35 What is clear, however, is that beginning the 1840s and 1850s the ram, which had been available since the eighteenth century, enjoyed a new popularity among Americans seeking the most advanced and useful technologies with which to fuel domestic and national progress.
Nationwide interest in improvement sparked a similar interest in pumps, and, like the ram, the utility of pumps rested both in their simplicity and in the fact that they facilitated the task of creating household running water systems. Households used hand pumps to transfer water into and around the house. Pumps stationed outside enabled people to move water out of an outside well or subterranean cistern, but a pump installed inside the house and connected by pipes to an external water source eliminated trips outside and thereby increased the convenience of the water supply. In many mid-nineteenth century houses, a pump stood adjacent to a kitchen sink, or in a "pump room" off the kitchen. The forcing, or "garden," pump consisted of two valves and a piston. Pumping the handle moved the piston up and down. When the piston was raised, the valve located below it rose, allowing water to fill the piston chamber and exit pipe. Pushing the handle down lowered the piston and closed that valve, but a second one, located in the exit pipe, opened, freeing the trapped water which then flowed out through the spout. One writer remarked that people placed this device in their yards, with "the suction pipe extending into a well, and the ascending [discharge] one to a cistern in the upper parts of the building." The lifting pump, however, better served the purpose of raising water up several floors. Thomas Ewbank, who published several editions of his exhaustive mid-century study of "hydraulic" machines, described the "modern" lifting pump as "one of the most useful forms of the pump for household purposes: it may be placed in the kitchen, cellar or yard, and will not only draw water from a well, but will force it up to every floor of a dwelling." This device differed from the force pump in that it lifted, rather than pushed water, into the discharge pipe. The
cylinder was immersed in water, so that as the piston moved up and down, water was always above it, waiting to be pushed out of the discharge pipe. The valve was in the piston itself; pulling up on the handle pushed the piston down, forcing the valve open so that water flowed through and above the piston. Pushing down on the handle forced the piston up against the head of water above it, closing the valve and lifting the water up and out of the discharge pipe.\textsuperscript{39}

The Elevated Interior Cistern

In theory, it was possible to run pipes from an inside pump to water fixtures, such as sinks, bathing tubs, and basins, and thereby solve the second water delivery problem, moving water throughout the house and into plumbing fixtures. As a way to deliver water, however, the interior pump had drawbacks. It worked well in houses where the water fixtures had been stationed on the ground floor, but proved less useful in houses where the homeowner installed water fixtures on upper floors: anytime someone wanted to use an upstairs sink or bathing tub, he or she had to pump water up from below. Instead, the convenient use of water fixtures demanded some other type of water storage device, one that would hold a large quantity of water, yet allow that water to move freely throughout the house. A cellar cistern held plenty of water, but it shared the same limitations as the sink pump: the only way to distribute water throughout the house was by pumping. At mid-century, then, the attic cistern served as the key to using water fixtures; it held large quantities of water inside the house, and its elevated position enabled the water to flow easily throughout the house.

The idea of placing a water tank in the attic seems so fool-hardy, that it would be easy to conclude that such an act would be the
aberration rather than the norm. Based on the frequency with which attic tanks are mentioned in house plans, magazines, and architectural books, however, it seems safe to conclude that they were rather common. A Staten Island home, probably built in the very late 1860s, had an 8-by-12-by-4 foot copper-lined attic tank. Orson Fowler installed several elevated cisterns throughout his house. A Boston house remodeled in 1860 had an attic tank, presumably to hold Cochituate water. The owner of a Canton, Massachusetts, dwelling built in the late 1840s pumped well water into his attic reservoir. A New Haven house used an attic tank as did houses at West Troy, New York, Baltimore, suburban Philadelphia, and Orange, New Jersey, all of them built in the 1850s or early 1860s (Fig. 3.4).

Plans for proposed houses published in magazines and books also included attic tanks. For example, Calvert Vaux's Villas and Cottages included plans for a "suburban cottage on a small scale" that used tin pipes to channel rain water into the attic cistern. Architect Samuel Sloan included attic tanks in several of his house plans published in the 1850s as did George Woodward in his collections published during the following decade. Sloan's plans tended to be for large ornate villas of brick and stone, while Woodward's were for two story frame houses of good but not enormous size, but both men emphasized the use of water fixtures and running water based on attic cisterns. In large cities and small towns, in country and in suburb, the attic tank served as the tool with which homeowners joined the convenience of running water with the convenience of water fixtures. When installed properly and used wisely, the elevated cistern enabled anyone to use water fixtures anywhere in the house.
Fig. 3.4 Vaux's Villas and Cottages showed this "suburban cottage" with an attic cistern.
Plumbers fabricated attic tanks by lining a square or rectangular wooden frame with slate, lead, or zinc; oddly enough, lead was probably the most popular of the three, although opinion certainly varied. For example, in his 1853 *Rudiments of the Art of Building*, John Bullock noted that while the "common material for the cistern . . . is wood lined with sheet lead . . . slate cisterns have been much used of late." However in his 1854 publication entitled *The American Cottage Builder*, he omitted any mention of lead for cisterns, noting instead that the "material used [was] commonly slate, . . . ." Writing during the same decade, architect Lafever claimed that "sheet lead" was good for cisterns, but added that "of late years" zinc had also been used to line cisterns. However, a look at the specifications for houses either proposed or actually built indicates that the use of lead continued throughout the period. For a block of "city houses" (attached dwellings built in rows), Ranlett specified the use of a lead-lined four hundred gallon attic reservoir. In an 1852 publication, Sloan included a five-hundred gallon attic tank made of "two inch plank" and lined with lead. George Woodward specified an attic tank of lead in an 1869 collection of house plans, and in his 1872 *Village Builder*, A.J. Bicknell included a three hundred gallon capacity lead-lined cistern in the attic of one house plan.

The attic tank increased the convenience of a household water supply. In cities with water works, for example, customers used the tanks in conjunction with water received through the public mains. When cities pumped water into elevated storage reservoirs and stand-pipes, gravity, rather than a massive pumping engine, provided the motive force for water traveling through mains and supply pipes. By the time water
reached the house, it often lacked the momentum necessary to carry it to upper floors. To compensate, customers pumped the water to an attic cistern; the elevation provided the fall necessary to move the water on through the house. In addition, some cities supplied water intermittently; the attic tank stored water in preparation for the days when the mains did not "run." In houses that relied on private water supplies, the attic tank served as an in-house storage tank. For example, in the Bickford house described in Chapter Two, a "force pump" connected to the cellar cistern allowed the family to pump water to a second cistern located above the bathing room. A Hudson River estate designed by Vaux used multiple cisterns, one situated above the bathing room, the others located underground but near the house. Leaders conducted rain water to the upper one, with the overflow being channeled to the subsurface tanks. John Hammond created a similar arrangement for one of the houses in his collection of plans published in 1858: pipes carried rain water to an attic cistern and the overflow to a cellar reservoir. A force pump in the kitchen transferred water to the upper tank as needed.

The attic cistern had drawbacks: its enormous weight placed a tremendous strain on the structure's framing members, and leaks quickly caused damage to ceilings. Despite these disadvantages, Philadelphia architect Sloan approved: a roof tank "filled by a force-pump at weekly or semi-weekly intervals, is highly recommended," he wrote. Fowler argued that "cisterns in the tops of houses [were] most desirable" because they saved inhabitants the labor of carrying water up stairs, and promoted cleanliness. "The water from every house should be carried into cisterns, constructed in its top, to be used in chambers . . . ,"
he urged. In order to avoid the cracked joists and leaky ceilings that large cisterns often caused, Fowler built smaller separate ones in the upper reaches of bedroom closets. Another writer regarded an elevated cistern as a necessity, especially "in the country" where there was no water works, even though its use required "the most severe labor of any performed in a house, requiring a man to perform it and being always a source of expense, trouble and anxiety." Even those who disliked the tanks recognized their usefulness. One writer declared it to be "always more or less an evil; it takes up a great deal of space, costs a great deal of money . . . , and often causes inconvenience, from leakage, . . . bursting of the service pipes . . . , and from the liability of the self-acting cock to get out of order." He conceded, however, that in some cases this evil was a necessary one, and supplied the reader with detailed instructions for constructing and operating an attic tank. Architect Gervase Wheeler expressed the same ambivalence toward the attic cistern, noting that the "large cistern in the roof is not always desirable, and as a constantly filled reservoir is scarcely ever so." As an alternative he recommended installing a smaller single-purpose cistern above the bathroom only, and using a force pump located on a lower floor to supply the tank. As noted earlier, Lewis Allen detested the attic cistern, and avoided its use by placing water fixtures on the first floor. But even he conceded that "the convenience and privacy" of the household's female occupants sometimes justified the use of upstairs fixtures and cisterns.
The Convenience of Running Water

At mid-century, then, Americans used a wide variety of technologies to both obtain and store water, technologies that, when linked together, enabled people to improve their daily lives through access to that most wonderful of conveniences, running water. Indeed, one thing mid-century observers agreed about, albeit with varying degrees of enthusiasm, was the value of running water inside the house, even if it extended no further than one sink in the kitchen. Those who have never had water piped into the house, remarked one writer, "often look with astonishment upon what they consider the extravagant expenditures made by their neighbors to accomplish this object" but "a proper estimate" of the labor saved in carrying pails and drawing from wells "would show that their own course is less thrifty." One architectural plan book declared piped water an "unspeakable privilege," which, once enjoyed, caused users to "wonder at the indifference with which this matter is regarded by many. . . . What folly to be digging deep wells, and daily to labor at clumsy sweeps and wheezing pumps, . . . when they might have the soft, pure, sparkling lymph laid on their houses to the very top, . . . ." Catharine Beecher concurred; when people erred by locating wells and cisterns outside and away from the house, "the mode of drawing and carrying [water] is excessively laborious!" How much simpler, she remarked, to arrange matters so that "by simply turning a cock, or working a small pump, the water will flow directly into the place where it is needed for use." If nothing else, noted George Woodward, water inside the house saved the health of the inhabitants since with it there would be "no running out in bad weather . . . [to] carry it back slopping to the house; . . . . ." A mid-century housekeeping manual
averred that "the saving of time, strength, patience, life itself, by having an abundant and unfailing supply of water brought into the house, is incalculable." Another writer agreed, observing that at the present day, a contrivance by which water may be conveyed directly into the kitchen, if into no other rooms, is considered indispensable. In the country, people are apt to set too low a value on the importance of these labor-saving accommodations. It is no small task to go out several yards from the back door to a pump or a well, especially in bad weather. The time saved by a good pump in the kitchen is a matter of no mean consideration.

Fowler stated flatly, that "to have plenty of hot and cold water all through the house is a luxury too great to be wanting in any complete house." He repeatedly emphasized the labor-saving attributes of the cistern-based running water arrangements in his house: such a supply saved the effort of hauling water up stairs, and it was "much more handy to turn a faucet and draw water direct into a pail, than to raise it from the well or from a cistern underground."

Three significant points emerge from these comments. First, these observers conceived of running water as something any household could have, regardless of whether the dwelling was in the city or country. In other words, they did not perceive "running water" as something that flowed strictly from the mains of a large-scale water works; a municipal water works was neither a necessary nor a first requirement for the enjoyment of running water. If this was the case, it followed, then, that while the use of plumbing depended on a supply of water, that supply did not have to come from a water works. Second, these observers viewed running water primarily as a labor-saving tool, one that made household life more convenient and pleasant, rather than as a tool of hygiene or sanitation. That is, none of these commentators argued in favor of running water solely on the basis of hygienic demands. The
health benefits of running water stemmed less from the achievement of a higher standard of sanitation and cleanliness than from the fact that running water saved people, and women in particular, from back-breaking drudgery that sapped their strength and broke their health. Cleanliness was surely a part of convenience, but it was not the only, or even the main part. Third, these remarks attest again to the new interest in what was, after all, a rather old idea. Technologically speaking, none of the devices that Americans used to create running water systems were especially new in the mid-nineteenth century. What was new, of course, was the nationwide interest in improving the quality of American life and in demonstrating to the world at large the potential for progress inherent in American civilization.

In the period 1840 to 1870, Americans used a number of tools to establish the household water systems that enabled them to create a better domestic environment. The variety of these tools—which ranged from hydraulic rams to hand pumps to attic tanks—served the needs of the equally diverse group of people united by their common interest in domestic reform. Domestic advice manuals offered guidance to the people who developed these water systems; those same manuals also taught American families how to manage the wastes that resulted from the use of water fixtures.

Domestic Drainage Technologies

"In cities and villages where no general system of drainage is carried out," remarked Scientific American in 1859, "it is not uncommon to find a cesspool built alongside of almost every house, . . . ." In his exhaustive treatise on American sanitation practice, James C. Bayles also noted the ubiquity of the cesspool, describing it as the "common
method" of disposal used in "country houses of the better class . . . [and] a majority of villages and unsewered towns . . . ."66 For Americans living in small towns, in rural or semi-rural areas, and in "suburbs," the cesspool provided what public policy often did not: a repository into which people could deposit accumulated private wastes. Cesspools proved useful for any household beyond the reach of a public sewer, of course, but for those that enjoyed water fixtures and in-house running water, the cesspool, when coupled with a network of household drainage pipes, served as the core of the household drainage system.

Despite its apparent ubiquity and necessity, the cesspool met with almost universal condemnation. One critic denounced cesspools as "magazines of filth and storehouses of disease. They generate pestiferous vapors, and should never be allowed near dwelling-houses."67 Bayles, who described the tanks as "indispensably necessary under a great variety of conditions," nonetheless found fault with them. He pronounced so-called leaching cesspools--ones built loosely of stone or brick and designed to permit liquids to flow into the surrounding ground--as "wholly bad [and] a fruitful source of disease and death . . . ." "Sewers are bad enough," he wrote, "but leaching cesspools at their best are liable to be worse than sewers at their worst . . . ."68 Others ranked the leaching cesspool as an even greater evil than the practice of tossing wastes out the back door or into an open drainage ditch, where at least they dried up after exposure to the air and sun. However, even the most vehement critics regarded the cesspool as a necessary evil, and hoped that wisdom would guide its use. Indeed, critics based their objections not on the cesspool itself, but on the way people built and used them. Loosely-structured leaching cesspools,
for example, allowed all manner of household liquid wastes, human and otherwise, to drain into the yard. The emanations from this swampy mass fouled the air or, worse yet, tainted water supplies stored in wells and cisterns. Loose pipe joints and badly-designed traps enabled gases and odors to drift back into the house itself. In addition greasy kitchen wastes coagulated on the inside walls of pipes, thereby blocking the free flow of wastes into the tank.69

Advice manuals addressed the task of proper cesspool use and construction. A cesspool-based household drainage system consisted of two parts: the cesspool itself, and the pipe network that connected it to the house, the water supply, and the water closet or privy vault. The use of a water-tight impervious tank rendered the cesspool less harmful, although it also had to be cleaned frequently, since all of the wastes, not just solids, accumulated in its depths. In form, cesspools resembled exterior cisterns: they consisted of pits lined with brick, stone, or cement. Architect Minard Lafever recommended that people build cesspools of "rubble or brick-work, with the top either arched or domed, or covered with flat stones," and cover them with a twenty-inch manhole that allowed access to the interior.70 The contract for a Woodstock, Connecticut, house erected in the late 1840s directed the builder to use "rough stone without mortar," while the contract for another house specified only that the reservoir be three feet square and topped with "mica slate stone."71 Descriptions found in Woodward's publications varied. His specifications for a New Jersey house ordered the contractor to build a cesspool six feet in diameter and six feet deep of "good building stone, laid dry, and covered with strong flagstone," while another set of specifications described a cesspool ten feet by ten
feet, with eight-inch thick walls of stone or brick topped with cement. A flag-stone and manhole covered the top. Even the imperfect leaching cesspool could be used safely, however, when people placed them at least one hundred feet from the house and its water supplies, and used drain tiles to channel seepage away from the house and water supply. Some manuals recommended channeling liquid privy wastes into a separate "liquid manure tank" rather than into the cesspool. Builders fabricated cesspool drain pipes of various materials. An 1850 publication recommended using white pine coated with "pitch laid on boiling hot," but writers more typically recommended brick, stone, or wood for drainage pipes. By the end of the 1850s glazed or "vitrified" earthenware pipe had become popular; unlike rough-surfaced iron, brick, and stone, glazed pipe's smooth but impervious surface facilitated the passage of greasy, soft wastes that would otherwise cling and putrefy.

Although people used the cesspool to capture most of the household's wastes, the installation of a privy or a water closet posed a separate problem in waste disposal design, one that mid-century Americans solved in one of two ways. In the first, people eliminated the vault completely, and instead drained wastes directly into a soil pipe attached to a drainage pipe that lead to the cesspool. Ranlett, writing in the late 1840s, described this method when he argued that whether the water closet was located indoors or out, it was "better not to be constructed over a sink, but with a basin in the seat, from which a soil-pipe extends to the drain, that conveys the sediment to a ses-spool [sic] at a distance from the house." Flushing all of the household's waste water through this drain, he continued, ensured that it would always remain clear. The contractor who built a Nahant, Mas-
sachusetts, house in the mid-1850s used this method (Fig. 3.5). Wastes from a second floor water closet flowed into a soil pipe that ran down to the cellar where it eventually joined a second drain that conveyed the wastes from a set of wash trays. The second drain, along with wastes from the first floor privy (and the kitchen sink), drained into a "main drain" that apparently terminated in a cesspool. This drainage plan thus eliminated the vault and instead used all of the household liquid runoff to flush water closet wastes out of the house.  

In the second method, people constructed a brick or stone vault beneath the closet or privy, and connected it directly to a cesspool, usually by means of a glazed earthenware drain pipe. This arrangement allowed a vault's liquid contents to trickle continuously into the water-tight drain pipe, and guaranteed that as long as a water supply also flushed the vault, all of the closet wastes would eventually be removed from the vault. The success of this method depended on the quality of the vault; at a minimum it needed to be "sufficiently deep" and walled, typically with brick. For example, the building specifications for a Germantown, Pennsylvania, house constructed around 1861 called for the "well of water closet to be walled with brick a sufficient depth . . . ." The specifications for Woodward's New Jersey house specified a vault five feet deep, with walls eight inches thick and "laid in best cement." Once the vault was in place, a water tight drain pipe conveyed the wastes to a cesspool, or, less typically, to a sewer: in two houses built in Philadelphia, Sloan used iron soil pipes to connect upstairs water closets to underground vaults, one of which was twenty feet from the house. In one of his house plans, Woodward also used an iron soil pipe to connect a second-floor pan water closet.
Fig. 3.5 Drainage plan. Soil pipe (dotted line running across stair) drained a second floor water closet, then connected with drain running parallel to back of house. "Main drain" runs parallel to wood room. T. Dwight house, Nahant, Mass. Basement story. Luther Briggs, Jr., Architect. Collection of the Society for the Preservation for New England Antiquities
to its "privy sink. An earthenware drainage pipe connected the vault to
the cesspool. A branch of the soil pipe extended on above the ater
closet itself to the attic cistern in order to utilize that tank's over­
flow in flushing the soil pipe. In another Woodward house, two three­
inch leaders channeled rain water into the shared vault of two first
floor water closets; a six-inch drain pipe connected the vault to a ces­
pool. As these examples indicate, water from roofs and cisterns
flushed closets and privies, and pipes carried wastes into vaults or
cesspools. Even where no public sewer or water supply was available,
there was no reason a well-drained, solidly constructed, and diligently
maintained water closet or privy could not add to the convenience and
ease of the household.

Homeowners and builders connected cesspools, vaults, pipes, and
drains in a variety of ways. Downing described the drainage system for
a "suburban cottage": a brick drain in the kitchen ran to a second
larger drain "some distance away," or to a "filtering reservoir" thirty
or fifty feet distant. He suggested constructing the latter by digging
a hole the size of "a cistern of ordinary capacity," cementing the
sides, covering the top with stones and soil, and adding a "smell-trap"
as a barrier between the house and the reservoir. Lafever offered
similar advice. He suggested that for draining both ground water and
household wastes

one main drain will be amply sufficient, leading either to a ces­
spool in the yard, or what is better, to a brook or other outlet in
the neighborhood. Into this may flow the refuse matters from the
kitchen, or other parts of the house, and also the rain from the
roof, if it is not wanted in the cistern. The best form for . . .
a drain is with a concave bottom, and a top which can be removed in
case of obstruction, . . . . It should have a smooth inner surface,
and a fall of at least two or three inches to a hundred feet. To
prevent the foul air which is generated in the drain from return­
ing, diptraps are indispensably necessary; these are also an effec­
The builder's contract for a Brookline, Massachusetts, house built in 1858 followed such a plan. The contract ordered the builder to "lay a suitable drain of the best glazed drain pipe in cement," and run it from the house to the "saveall." A separate glazed "stone ware drain" carried water from the privy vault, slop sink, and rain gutters into the first drain.84

Regardless of whether they lived in city, village, farm, or suburb, Americans interested in improving household efficiency and comfort could use the information provided in magazines and books to create convenient water supply and waste removal systems. They constructed them by using a variety of technologies such as cisterns, cesspools, pumps. Americans treated these devices, none of which were particularly new or novel, as objects that could be improved if not redesigned in order to meet American needs, and then utilized in the home in order to better domestic life. The project of domestic improvement of course contributed to national progress, and helped ensure a safe and vital future for the American people and their social and civil institutions. Supply and waste systems proved most useful, however, when united with a variety of water fixtures. The next two chapters examine mid-century fixtures in detail.


Edgar W. Martin, The Standard of Living in 1860: American Consumption Levels on the Eve of the Civil War (Chicago: University of Chicago Press, 1942), 41. The important large municipal water works have absorbed historians' research energies, so that little is known about the technology and structure of less sophisticated municipal systems, nor is much known about how people who lived beyond the reach of a public system obtained their water. Martin's assessment is one of the best available but it is tantalizingly vague: he deemed the use of source citations "unnecessary," noting only that he had relied on city water department reports, local histories, and "various other materials." (39) An excellent starting point for an overview of nineteenth century water works construction, large and small, is M. N. Baker, ed., The Manual of American Water-Works, 4 vols. (New York: Engineering News Publishing Co., 1889–1897). Baker's compilation is especially useful because it provides a great deal of information about the kinds of water supply arrangements constructed by municipalities and private corporations in the first half of the nineteenth century, before the onset of the late century spate of water works construction.


Historians have not explored the role of water sellers and water carters. Terry Reynolds asserts that in mid-nineteenth century Shreveport this was an especially expensive way to obtain water: a bucket sold for five cents, a barrel for fifty cents. See his "Cisterns and Fires," 341. But after a municipal works had been built in Peoria, Illinois, city ordinance prohibited cartmen from charging more than fifteen cents for each barrel of city water (the sellers paid three cents per one hundred gallons of water.) See the city of Peoria, Peoria Water
Works, "An Ordinance Fixing the Rates of Water from the Peoria Water Works, in the City of Peoria," Ordinances for the Government of Water Takers, Plumbers, &c. (Peoria: Transcript Printing and Blank Book Co., 1869), 4. According to one source, Chicago water carters continued to peddle their wares through the early 1850s, even after a fairly good piped water supply was available. See Industrial Chicago: The Building Interests (Chicago: The Goodspeed Publishing Co., 1891), 307.


In Milwaukee, for example, one historian has estimated that in 1870 citizens used over thirty thousand wells. See Jordan, "Origins of the Milwaukee Water Works," 3. A discussion of wells and well digging is in Sereno Edwards Todd, Todds Country Homes and How to Save Money (Hartford, Conn.: Hartford Publishing Co., 1870), 215-25.


7Contract, Sarah D. Bird house, Brookline, Massachusetts, 1858, Box 3, Folder 13A, Society for the Preservation of New England Antiquities. Also see Specifications and Contract for the Salem Griggs house, Grafton, Massachusetts, 1849, Box 3, Folder 18, SPNEA.


16 The footnotes that follow cite many examples from the popular press, but for other general discussions see Thomas Webster and Mrs.


19 The specifications for a cellar cistern directed that it "be bedded 4 inches deep with fine rubble, and water-lime cement . . . poured on and tamped while soft, . . . ." Layers of brick, "water lime," and cement covered both the base and sides. See Hammond, *Farmer's and Mechanic's Practical Architect*, 125.


20 Contemporary advice manuals and magazines almost never mentioned elevated exterior cisterns, but surely some people used them. For a photograph of one see Reynolds, "Cisterns and Fires," 367.


People piped water into a house for two purposes: cooking and drinking, or as "fuel" for various plumbing technologies. For the second purpose, any water would serve, although most observers agreed that soft water (meaning usually rain, as opposed to spring or river, water)
was less problematic, since it was less likely to leave "encrustations" of lime on the surfaces of objects.


Drawer 5, File 4, sheet 4; Chamber Story Plan, Asahel Glover single house, Dorchester, Mass., 1857, Drawer 5, File 4; Contract, Sarah D. Bird house, Brookline, Mass., 1858, Box 3, Folder 13A; Principal Story Plan, B. T. Manson house, Harrison Square [Boston], 1859, Drawer 5, File 6, sheet 4.


Ewbank, Hydraulic Machines, 263.

Ibid., 277.


A cistern 6'6" by 5'4" by 3' would weight approximately three and a quarter tons. The cistern dimensions are mentioned in Woodward and Thompson, Woodward's National Architect, 10. My thanks to Professor Robert E. Schofield for the tonnage calculation.

Ranlett, The Architect, 2:10, 32; Fowler, A Home for All, 132. The second Staten Island house is described in Atwood, Country and Suburban Houses, 236, 237. The Boston and Canton houses are shown on plans held at the SPNEA: Emerson alterations, Boston, 1860, Drawer 5, File 2; Contract, Gideon F. Thayer Reed house, Canton, Massachusetts, 1848, Box 3, Folder 14; also see Leonard Blanchard house, East Abington, Massachusetts, 1859, Drawer 5, File 4. The other examples are in Henry Hudson Holly, Holly's Country Seats: Containing Lithographic Designs for Cottages, Villas, Mansions, Etc., with Their Accompanying Outbuildings; Also, Country Churches, City Buildings, Railway Stations, etc., etc. (New York: D. Appleton and Co., 1863), 110, 145; Marcus F. Cummings and Charles C. Miller, Modern American Architecture (Toledo, Ohio: by the authors and S. Bailey & Co., 1868), text following Plate 13; Thomas Dixon and J.M. Dixon, "Hints on Rural Homes," Rural Register 1 (1860): 79; Chas. Duggin, "How to Build Your Country Houses," Rural Register 2 (1860): 39; Sloan, Model Architect, 1:152.

Other built houses that included attic tanks are in Brown, Carpenter's Assistant, 132; "Frontispiece," Horticulturalist 11 (1856): 25-27; Charles Duggin, "How to Build Your Country Houses," Horticulturalist


Other published house plans with elevated interior tanks are in John Hall, A Series of Select and Original Modern Designs for Dwelling Houses, for the Use of Carpenters and Builders, 2d ed., (Baltimore: John Murphy, 1840), 27; Bullock, American Cottage Builder, 220, 241; "An Italian Cottage," Rural New-Yorker 6 (1855): 5; Hammond, Farmer's and Mechanic's Practical Architect, 119; Duggin, "How to Build Your Country Houses," 167; Sloan, Homestead Architecture, 217.

Despite the possible dangers of lead, it remained one of the more popular materials for lining cisterns and tubs and for fabricating pipes. According to one plumber, the "plumbing of an ordinary house" in 1840 New York City included lead-lined sinks, tubs, showers, and water tanks; see Felix, "A Talk With An Old Plumber," Sanitary Engineer 4 (1880-81), 525. Indeed, for most of the mid-century period Americans continued to define the work of a plumber as one who specialized in lead work, which included fabricating lead cistern linings. A good description of the fabrication of lead linings is in Shaw, Civil Architecture; or a Complete Theoretical and Practical System of Building, 3rd ed., rev. and enl. (Boston: Marsh, Capen, and Lyon, 1834), 167. A variety of works described the work of plumbers, many of them English in origin but widely reprinted in the United States. See Gallier, Builder's General Price Book, 113-114; Shaw, Civil Architecture, 165-67; Edward Hazen, Popular Technology; or Professions and Trades, 2 vols. (New York: Harper and Brothers, 1846), 2:240; A.C. Smeaton, The Builder's Pocket Companion (Philadelphia: Henry Carey Baird, 1850; London, 1825), p. 138; Bullock, Rudiments, 142-143; Lafever, Architectural Instructor, 426.

Bullock, Rudiments, 78; Bullock, American Cottage Builder, 196; Lafever, Architectural Instructor, 408.

Sloan, Model Architect, 1:14; Ranlett, City Architect, 16; Woodward and Thompson, Woodward's National Architect, 15; Bicknell, Village Builder, specifications for Plate Two.

Bullock, American Cottage Builder, 195-6; James Bayles, House Drainage and Water Service (New York: David Williams, 1878), 104; "Automatic House Tank Pump," Technologist 2 (1871): 62; George W. Fuller, "Water-works," in "Historic Review of the Development of Sanitary Engineering in the United States During the Past One Hundred and Fifty Years," Proceedings, American Society of Civil Engineers 53 (1927), part 2, 1587. In Chicago, according to one source, the water works could only move water up three stories; occupants of taller buildings had to
store their water in roof-top tanks. See Industrial Chicago, 310-311. So-called high duty, direct acting pumping engines, powerful machines that pumped water directly into mains rather than just into a large reservoir, first appeared in the United States in the 1860s, and reached an advanced stage of design in the 1870s and 1880s. See Hunter, Steam Power, 521, 548-61, passim.

47 Bullock, American Cottage Builder, 195-6; Bayles, House Drainage and Water Service, 104.


49 Architects George Woodward and Daniel Atwood recommended careful construction techniques in order to avoid the dangers of attic cisterns. Woodward dictated that a 6'6" by 5'4" by 3' cistern sit on fourteen by four inch beams, "bearing upon main partition . . . and framed with headers of the same size . . . ." In one set of his contract specifications, Daniel Atwood ordered the builder to "[s]trengthen the floors of the tank room, by doubling the number of the beams, 2 to 1" for the ones otherwise specified for the framing of the structure. See Woodward and Thompson, Woodward's National Architect, 10; Atwood, Country and Suburban Houses, 236.

50 Sloan, Homestead Architecture, 154.

51 Fowler, A Home for All, 132, 147.


53 Bullock, Rudiments, 78-79.

54 Wheeler, Rural Homes, 186.

55 Allen, Rural Architecture, 122-23.

56 "Hints Upon Farm Houses," 3.

57 Cleaveland, et al., Village and Farm Cottages, 35.

58 Beecher, Treatise on Domestic Economy, 270.

59 Woodward, Woodward's Architecture and Rural Art, 104.

60 Joseph B. Lyman and Laura E. Lyman, The Philosophy of House-Keeping: A Scientific and Practical Manual for the Preparation of all Kinds of Food, the Making Up of All Articles of Dress, the Preservation of Health, and the Intelligent and Skillful Performance of Every Household Office [sic] (Hartford: Goodwin and Betts, 1867), 455, also 447, ff. Also see [Backus,] "Hints Upon Farm Houses," 3.
Grand water works like the Croton Aqueduct offered people a new way of organizing water supplies, rather than an entirely new commodity. It may have been more convenient, cheaper, or more pure, but beyond that what distinguished the central public water works from its predecessor was scale and organization. Americans promoted large-scale centrally-organized water works as a tool with which to accomplish more efficiently certain specific tasks, and only secondarily as a way to improve household convenience. City officials urged the construction of works in order to improve fire fighting, or to promote commerce and industry, by providing local businesses with abundant water for production processes. As importantly, "city water" enabled residents to enjoy pure water, since its use eliminated the need to rely on polluted wells. Indeed, the most immediate domestic health benefit (as opposed to commercial advantage) of "public" water was that it could replaced befouled wells: as Edwin Snow’s investigations in the late 1840s showed, tainted water caused illnesses that could quickly reach epidemic proportions, bringing chaos and disorder to communities. But the drive to provide acceptable drinking water (or even to provide water for public baths) should not be confused with a desire to provide household convenience in the form of running water. City leaders or water company officials certainly expected residents to buy water; indeed, they literally counted on them doing so, since water rents constituted a large part of a works’ revenue. Moreover, once a works had been built cities passed ordinances that established rules for household use as well as rates customers could expect to pay. But as water department reports indicate, officials were rarely prepared for the extent to which households both used and wasted water. Household running water was, if not an afterthought, an incidental side benefit to the more central one of community stability and well-being.

Discussions of nineteenth century Americans’ attitudes toward and the purposes of public water supplies are in Reynolds, "Cisterns and Fires," esp. 346-47; Blake, Water for the Cities, 37, 133, 172-73, passim; Galishoff, "Triumph and Failure," 36-37; Tarr, "Evolution of the Urban Infrastructure," 12-13; Sam Bass Warner, The Private City: Philadelphia in Three Periods of Its Growth (Philadelphia: University of Pennsylvania Press, 1968), 109; Ogle, "Redefining 'Public' Water Supplies," 526-27. Two good discussions about the extent of waste are in James Slade, "Report Made to the Water Commissioners of the City of Baltimore, June 18, 1853, on the Subject of Supplying the City with Water," in Report of the Commissioners Appointed by Authority of the Mayor and City Council to Examine the Sources From Which A Supply of Pure Water May Be Obtained for the City of Baltimore (Baltimore: James Lucas, 1854), 121, 130-33; and Minority Report of Mr. Ross Winans, one of the Water Commissioners, Appointed by Authority of the Mayor and City Council to Examine the Sources From Which A Supply of Pure Water May Be Obtained for the City of Baltimore, and A Supplementary Thereto (Baltimore: American Times Office, 1853), 18-23. Both reports contain considerable comparative information about per capita water usage in
other cities.

65 "Drains and Cesspools," *Scientific American* n. s. 1 (1859): 50.


67 "Drains and Cesspools," 50.


British experience may have influenced the popularity of earth-

76 Ranlett, The Architect, 1:69. Similar advice is in Bullock, American Cottage Builder, 204-05.


78 Dwyer, Economic Cottage Builder, 51.

79 John Riddell, Architectural Designs for Model Country Residences (Philadelphia: John Riddell, Lindsay and Blakiston, 1861), specifications for Villa No. 11; Woodward and Thompson, Woodward's National Architect, specifications for Design No. 6, p. 3.


81 Woodward and Thompson, Woodward's National Architect, specifications for Design No. 1, pp. 11, 13, 14, specifications for Design No. 6, pp. 2, 3, 8. 14. Also see specifications for Design No. 10. An especially graphic example of the vault-to-cesspool drainage connection is in the Society for the Preservation of New England Antiquities: Mer- riam house; but also see Specifications, Cushing house; Vaux, Villas and Cottages, 47; and Fowler, A Home for All, 137.

82 Downing, Cottage Residences, 37. Similar advice is in Ran- lett, The Architect, 1:69.

83 Lafever, Architectural Instructor, 411.

84 Contract, Bird house, 1858. Other SPNEA holdings with especially good drawings or contract descriptions are Daniels house; Cushing house; Merriam house; Dwight house. Other descriptions of drainage practice are in Bullock, American Cottage Builder, 201-04; Wheeler, Rural Homes, 234; Cleaveland, et. al., Village and Farm Cottages, 163; Goodholme, Cyclopaedia, s. v. "Drainage," 166-67.
CHAPTER 4

HOUSEHOLD WATER FIXTURES IN FORM AND FUNCTION:
SINKS, TUBS, BASINS, SHOWERS, FAUCETS, AND BOILERS

Running water improved the domestic environment by adding convenience and ease to daily life, but families maximized the utility of a water supply, and thus its convenience, with the addition of one or more water fixtures to the household. As noted in Chapter Two, mid-century plumbing installations ranged from the very simple to the complex and expensive. Plumbing supply houses obliged consumers by selling a wide range of products from which customers could pick and choose in order to create the best water fixture systems for their particular needs. This chapter examines the fixtures available to mid-century Americans.

Sinks and Washbasins

In the middle decades of the nineteenth century, Americans treated two of the most common water fixtures, washbasins and sinks, as two separate objects, used for separate and different functions. At mid-century the word "sink" denoted a place for drainage or wastes, such as a privy vault. "Slop sinks" were small closets with hoppers into which household wastes could be tossed, rather than places that held water used for personal hygiene.¹ Contemporary house plans usually showed the "sink" in or near the kitchen, sink-room, or pump-room, and "washbasins" in bedrooms and bathrooms (Fig. 4.1).² In houses without bathing rooms or washbasins, people may have used the sink for bathing, although it seems more likely they used washstands; as a rule, however,
Fig. 4.1 This Long Island villa had a sink room off the kitchen. Notice the water closet at the back of the wood room. Also see the wash room and sink in fig. 2.7
contemporary writers rarely associated sinks with personal hygiene. For example, a domestic "encyclopedia" published in the 1840s defined the sink as a place "to wash dishes in, or other articles, and likewise to receive and convey away the dirty water." Under the heading "sink," another domestic encyclopedia, this one published in the late 1870s, noted that "every kitchen should have a sink," but the discussion that followed said nothing about using that object for bathing. Instead, the same encyclopedia described the "sink room" as "the place where are performed the ungraceful operations incident to care of food and the person." The writer did not enumerate those "ungraceful operations," but presumably they included dish washing and pan scouring, as well as the cleaning and preparation of food. Catharine Beecher defined the "sinkroom" as the place in which "the washing, baking, and sink-work may be done; so as to withdraw all the most soiling employments from the [kitchen]."

The materials used for fabricating sinks varied during the period. The 1845 American edition of the British Webster-Parkes domestic encyclopedia pronounced "hollowed-out" stone as the best material for sinks, but conceded that many people used what are sometimes referred to as "drysinks," wooden cabinets whose surfaces consisted of a metal-lined trough (usually lead or zinc). A few house plans and specifications from the 1840s and 1850s mention such sinks. A house built in 1849 boasted a "good sink" made of "eastern lumber," and a Brookline, Massachusetts, house built in the late 1850s had a kitchen sink of "hard pine." John Ritch's American Architect, published in the early 1850s, specified a sink "made of stout plans, put together with white lead in the joints," and Ranlett's 1856 City Architect called for
a "lead-lined water sink." But beginning in the early 1850s architects and advice manuals routinely suggested using sinks made of other materials. When H. B. Rogers remodeled his Boston house, he installed two new sinks, a soapstone one in the kitchen, and an iron one in the washroom. Samuel Sloan used a variety of sinks, including ones made of iron, "enamelled iron," and soapstone, and some that were copper-lined (the latter may have been drysinks.) In the late 1860s George Woodward called for iron or cast-iron sinks in his house plans, as did Amos Bicknell in his Village Builder.

Manufacturers and plumbing supply houses carried these ready-made sinks. The William Schoener Company, a New York City company with a "manufactory" in Bridgeport, sold rectangular iron sinks in a range of sizes. The company’s 1860 catalog showed some that ranged in size and price from eighteen-by-twelve-by-four-inches for seventy-five cents, to a model seventy-eight-by-twenty-eight-by ten-inches that sold for twelve dollars. In the 1860s the Eagle Iron Works, also of New York, sold iron sinks for the same price as that of the Schoener Company, but Eagle also carried a line of "enameled" iron sinks for prices about double those of the plain iron models. Despite what seems like a wide range of choice, sinks were probably the most uniform of all mid-century water fixtures. A potential buyer could have a drysink made to order, but purchasers of ready-made items found their options limited primarily to iron and enamelled iron. But plumbing supply houses found other ways to accommodate a diverse group of users. For example, for fifty cents more, Eagle Iron Works customers could buy a sink with an overflow, or a set of ornately carved legs that fit any of the sinks (Fig. 4.2). (The sinks featured in the catalog had two legs, indicating
the company expected them to be permanently attached to a wall.) In addition, the company sold, for $1.25, a portable sink stand; two pedestal legs supported the sink at either end, allowing the user to install it "in any part of a room" and save the expense of "boxing up the sink."13

Washbasins, on the other hand, came in a greater variety of styles and materials, perhaps in part because unlike sinks, washbasins often appeared in the front of the house in wash closets used by guests. A commentator writing slightly after the mid-century period described the washbasin as "the distinctive luxury of the Northern States . . . . There are thousands of modest dwellings, destitute of any other plumbing work, which display their one set basin, either in the best chamber, or, . . . parlor, for greater effect upon visitors; and Americans generally of all classes take great pleasure in marble slabs and running water."14 Certainly the diversity of basins sold at mid-century attests to this fixture's popularity with those who used plumbing. Basin bowls typically were round, rather than rectangular, and made of iron, enamelled iron, marble, or earthenware. Samuel Sloan, working in the 1850s, and George E. Woodward in the late 1860s, both favored marble and earthenware basins. Sloan's plumbing specifications routinely called for "china" basins, and Woodward sometimes used "white marble pattern basin, Wedgewood [sic] ware," in his house plans.15 The Rogers remodeling job in Boston called for "porcelain wash bowls with marble slabs and plated facets [sic]."16 The Trevor Parke house built in the mid 1860s boasted no less than fourteen washbasins, most of them "fancy" and "marble."17

But the same observer who remarked on the ubiquity of washbasins in America also noted that while "while the combined bowl and
SINKS WITH LEGS.
Sinks of same price and sizes as on page 1.
Legs for the same, (each leg,) 50 cents.
They make a very neat finish, and save the necessity of boxing.

SINKS WITH IRON BACKS.
Sinks same price and sizes as on page 1.
Legs for the same, each 50 cents.
Iron Backs for same made to order.

Fig. 4.2 The Abendroth Brothers catalog showed sinks with these ornate legs
slab in one piece of porcelain" was "most agreeable," Americans found little use for it: this type of basin, he explained, was "common in England but rarely seen here," primarily because of its fragile nature.18

Instead, plumbing supply houses met American needs by selling a wide variety of durable basins. For example, the Abendroth Brothers sold iron washbasins in three sizes—fourteen-, fifteen-, and sixteen-inch diameter—and in three finishes—plain, painted, and enameled. Prices for the fourteen-inch basin in the three finishes were, respectively, seventy-five, cents, eighty-eight cents, and $1.75. In addition the company also carried portable washstands that had waste pipes attached to the basins.19 The Jones Company of New York sold iron, earthenware, and marble basins, some of which had overflow mechanisms. The company's catalog also featured a selection of basin and slab combinations, in either marble or "white," which may have been either enameled iron, marble, or soapstone (Fig. 4.3). The slabs were either square or triangular (for corner installation) and some included soap cups, brush trays, and overflow devices. Jones also sold elegant portable iron washstands that looked very much like built-in sinks, complete with faucets, overflow, and swinging soap trays, as well as a line of iron products manufactured by the J. L. Mott Company, such as a cast iron corner sink with an iron frame that surrounded and concealed the pipework (Fig. 4.4). The catalog described its "half circle wash stand," also a Mott product, as being especially "superior over all others" because of the "Slab and Bowl being made separate, so that for shipping purposes each part can be nested and packed securely in a small
SLABS AND BASINS.—CONCLUDED.

No. 3. Square Slab, Basin, and two Soap Cups, combined with Pat. Overflow.

Slab, 17\(\frac{1}{4}\) x 17\(\frac{1}{4}\).
Basin, 13 in. inside.
White.
Marbled.

Fig. 281.

No. 4. Slab, Basin, Soap and Brush Trays, combined with Patent Overflow.
Slab, 17 x 24.
Basin, 13 in. inside.
White.
Marbled.
Same as No. 4, without Soap and Brush Trays.
White.
Marbled.

Fig. 282.

No. 5. Corner Slab and Basin, with Overflow.
Slab, 20 in.
Basin, 12\(\frac{1}{4}\) in. inside.
White.
Marbled.

Fig. 283.

Slab, 14 in. square.
Basin, 12 in. inside.
White.
Marbled.

Fig. 284.

Fig. 4.3 Jones and Co. sold a variety of washbasins.
Fig. 332.
Moll's Patent Half Circle Wash Stand, with Overflow.
New Pattern, 1867.
No. 33.

Fig. 4.4 One of the Mott washstands sold by Jones and Co.
space." The catalog claimed that, when enameled, the iron rivaled marble in durability and beauty and at a lower price. The 1859 catalog published by Naylor and Willard, another New York plumbing supply house, showed one marble "corner slab," a single piece with the basin carved out, which sold for $1.12 per foot.20 Looking back at mid-century plumbing practice and fixtures, a Chicago plumber remarked that as a "'class of goods,'" both earthenware and enameled basins had drawbacks. The former broke easily and thus could not be fitted readily into tight spaces, while the latter met with disfavor because of the ease with which the enamel chipped off the iron surface.21 This wide range of products and prices attested not only to Americans' interest in domestic improvement, but also to the scope of that interest: the items described here suited the needs of people living in large ostentatious villas, in modest "city" houses, and in suburban cottages. But these products also indicate that by the 1850s and 1860s Americans had developed a complete line of water fixtures; there was little need for anyone interested in installing plumbing to purchase goods made abroad.

During the 1840s and 1850s, Americans installed washbasins primarily in their "chambers," or sleeping rooms; ones located in bathing rooms or in main floor "wash closets" were not unknown, but they became more popular in the 1860s and after. During the earlier decades it made sense to install the basins in bedrooms because the newly-installed and permanently-affixed washstands connected to supply and waste pipes simply replaced the portable objects--table, ewer, and basin--used before.22 Indeed, the water fixtures sold in catalogs replicated the portable washstands they replaced. The Webster-Parkes Domestic Encyclopedia included illustrations of numerous portable wash-
stands, most of which were small tables with one or more shelves, although one included its own water cistern, a stop-cock to release the water, and a basin with plug so that wastes could fall to a collecting basin below. The water basins fit into a cut-out on the surface of the stand so that the basin's rim lay flush with the shelf surface; a lower shelf held the water pitcher. These portable stands generally had wooden frames but marble slab shelving, which proved more resistant to water and soap than a wood surface. It was but a short step to attach these portable stands to supply and waste pipes, and the basins designed for permanent installation shown in catalogs and described in architectural plan books were almost identical to their portable counterparts. In the 1850s, the author of The Economic Cottage Builder advised his readers that "every bedroom ought to be supplied with a corner washstand, formed as a shelf, either of marble, porcelain, marbleized iron or slate, with basin, escape-pipe, and supply, the latter conveying . . . water from the cistern, and the former letting off dirty water." A decade later an architectural journal noted that the "plan of movable pitcher and basin, with attendant slop-bucket for chamber service, is giving way to the superior claims of permanent wash-basins with marble tops, and cold and hot-water supply and waste-pipes." These descriptions of permanent fixtures indicate that they closely resembled their predecessors: the "shelf" and basin described in the The Economic Cottage Builder sound very like the washstands shown in the Webster-Parkes encyclopedia. The decision to attach fixtures permanently to the wall and to supply them with running water merely increased the convenience of familiar household objects.
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**Bathing Tubs and Showers**

Among contemporaries, sinks and washbasins typically provoked little comment, which is hardly surprising since those fixtures merely duplicated items that had long existed in the household, albeit with the added convenience of running, rather than hand-poured, water. People generally described these fixtures as objects that contributed to convenience. Bathing tubs, on the other hand, prompted somewhat different commentary, in part because of Americans' mixed feelings about bathing's utility and safety, but also because people tended to treat the bath, more so than other water fixtures, as a convenience particularly related to health. For example, one writer complained that the bathing room "was not very usual in country dwellings," but urged its inclusion in homes because of "the contribution which it would afford to . . . health and physical enjoyment" by the occupants. Andrew Jackson Downing concurred, noting that a bathing room "requires little space, . . . and its great importance to health renders it a most desirable feature in all our houses." An 1855 publication also treated the bath as a household item associated especially with health, albeit one dependent upon class, when it argued that "no well arranged cottage of the better class should be without a bath-room in the neighborhood of the bed-chambers" used by invalids, presumably so that the ill could take advantage of the bath's curative powers. Lafever expressed similar sentiments when he argued that bathing equipment "should be provided if possible in every house, and in large houses on every story in which there are sleeping apartments, for the better preservation of the inmates." Since mid-century Americans often used bathing as a medical treatment, the identification of the bath as a tool of health, rather
than one of simple convenience, comes as little surprise. However, these comments reinforce a claim made earlier: these observers linked the bath specifically to health, but they did so conditionally.

Among those who bought and installed water fixtures, however, the bathing tub proved to be almost as popular as other water conveniences. In Boston, for example, the installation of bathing tubs lagged behind that of washbasins and water closets, which is not surprising considering that a house with fixtures often had more than one water closet or basin, but usually only one bath. Nonetheless, by 1853, Boston water takers already owned over eighteen hundred tubs, as compared with almost twenty-five hundred w. c.’s and over three thousand wash basins. In 1860, those numbers stood at 3,334, 7,345, and 7,729, respectively. In Cambridge, by the end of 1871 the number of bath tubs owned by water customers hovered around one thousand, while closets and basins stood at about fifteen hundred and eighteen hundred, respectively. In Baltimore, on the other hand, in 1863 there were more than twice as many bathtubs as water closets, a pattern which held true in 1870. Moreover, beginning with John Hall’s 1840 architectural plan book, virtually every collection of plans published at mid-century included many houses with bathing rooms, and the frequency with which published house plans included a bathing room increased toward the end of the period.

At mid-century the tub itself was hardly a novelty, but the fixed or permanent bathing tub, installed in a room devoted specifically to its use and attached via pipes to a water supply, was new. Architect Lafever described such an arrangement in his 1856 Architectural Instructor:
A bath-tub may be made of wood lined with lead or zinc, or of tin painted, or of copper tinned over, or of cast-iron painted, or of marble. Pipes for cold water from the cistern above, and for hot water from the boiler in the kitchen, may be fitted to discharge into it, and a waste-pipe to carry off refuse water into the soil pipe.37

In the 1840s and 1850s Americans placed the tub in a room devoted to its use, usually, but not always, on the second floor, near bedrooms.38 The practice of separating the bathing tub (and its partner, the shower) from the water closet and washbasin was not as inconvenient or illogical as it may seem: people did not immerse themselves in water every day or even every week, but they probably washed their hands and face, or took sponge baths more often. As a result, it made sense to put the washbasin in the bedroom, and the less frequently used tub in a separate room.39

As Lafever's comment indicates, Americans used tubs fabricated of a variety of materials. A few mid-century manufacturers produced cast iron ones. T. M. Clark described enamelled cast iron tubs as "much the best," but noted that, when filled with hot water, a cast iron tub’s expansion and contraction caused the enamel to chip and scale.40 The mid-century home more likely contained a tub that consisted of a wooden frame lined with zinc, lead, or copper. For example, in his 1852 Model Architect Sloan included an enamelled iron tub in the specifications for one house plan, but other plans called for tubs "made of boards, paneled in front, and lined with lead."41 William Ranlett's 1856 City Architect listed a zinc-lined tub as part of the cost of one house plan, and the specifications for a Germantown, Pennsylvania, house shown in Riddell's 1861 Architectural Designs described the tub as "6 feet long, and 2 feet wide, 2 feet 2 inches deep, and . . . made of 2 inch plank, grooved and tongued at the angles, and put together with white lead, and lined with
zinc."\textsuperscript{42} Many house plans called for tubs lined with "planished copper," a material one plumbing manufacturer described as "the favorite bath for many years."\textsuperscript{43} According to a Chicago plumber, in the 1840s and 1850s his colleagues in that city fabricated tub linings from sheet lead and zinc, but "chiefly zinc," although in his view "the lead-lined wood bathtub was the best ever used. It would last ages on ages" when properly made.\textsuperscript{44} Plumbing supply houses obliged consumers by selling tubs in a variety of models, sizes, and prices. The Naylor Company sold a zinc-lined tub, priced at eight dollars, as compared to $20.67 for one with a copper lining. The rectangular copper tubs sat on the floor, but cast iron tubs stood on the four claw feet usually associated with the Victorian bath tub.\textsuperscript{45} Presumably cast iron, being sturdier than copper, could stand alone without the benefit of a surrounding frame. Certainly an iron tub was cheaper: the Abendroth Brothers sold a six-foot cast iron tub for thirteen dollars, but the Naylor Company sold a six-foot copper-lined tub for just over twenty dollars (Fig. 4.5).\textsuperscript{46}

Learning about the design and use of showers is more difficult. A Chicago plumber claimed that in the 1840s and 1850s "no bath tub was complete" without a then-handmade shower, and another plumber claimed that in 1840 New York, the average plumbed house had a "shower constructed of sheet lead, with a valve and pull."\textsuperscript{47} However these claims are almost impossible to verify, and architectural books rarely mentioned, and house plans never showed, showers. For example, in the otherwise detailed plumbing specifications included in their books, Sloan mentioned showers just twice, and Woodward once.\textsuperscript{48} There is a logical explanations for the omission of showers from house plans: since
CAST IRON OVERFLOW BATH TUBS.

LENGTH. WIDTH. DEPTH. PRICE.
No. 1, . . 66 in. 25½ in. 18½ in. $12 00
" 2, . . . 72 in. 25½ in. 18½ in. 13 00
" 1, with overflow, 66 in. 25½ in. 18½ in. 12 50
" 2, " " 72 in. 25½ in. 18½ in. 13 50

Fig. 4.5 Cast iron tub prices listed in the Abendroth catalog

people often attached the shower to the the bathing tub, or used a portable one that folded away when not in use, architects had no reason to indicate its presence on the house plan. But it may be the case that people used fewer showers: they did not treat the shower bath as a medicinal tool they way they did the immersion bath; so that it may be simply Americans used showers in much smaller numbers than they did baths.49 In its 1871 annual report the Cambridge, Massachusetts, water board enumerated the use of water closets, tubs, and wash basins, but no showers.50 That does not necessarily mean that none existed in the city, since the neighboring Cochituate Water Board had enumerated showers in that city in previous decades. In 1853, for example, the
Cochituate water registrar claimed that customers used 1,838 bathing
tubs, "most of [which had] shower baths attached," and fourteen "Shower
Baths" in "houses where there [was] no tub." By 1858 the number of
tubs with "attached" showers had risen to 3,334; the number of free-
standing showers stood at twelve.

But patent applications, which provide virtually the only sub-
stantive information about shower technology, indicate that American use
of the shower may have been greater than these numbers show. All during
the mid-century decades inventors applied for patents on a wide assort-
ment of showering devices. For example, H. H. King obtained an 1847
patent for a shower that used an attached force pump to push water up
into a storage tank (Fig. 4.6). To shower, the user pulled a handle
that moved one or both of two valves that released water through an
overhead shower rose, or through vertical perforated members that aimed
the spray at the lower body. An 1846 patent also included a pumping
mechanism, this one powered by user-operated foot pedals. Another
device, patented in 1845, combined tub, shower, and heating element in
one fixture; the heating element was built into the tub, and the bather
used an attached force pump to pump the hot water out of the tub and
into the shower's overhead reservoir. The "Niagara Bath," patented in
1849, gave bathers complete control over the direction and height of the
spray, which, according to the inventor, made the Niagara medically
superior to showers "of the common construction, as it is avoidable to
wet the head or any other part which it might be desirable to keep dry,
for the same reason also warm water can be used, which would be
altogether inadmissible if it fell directly on the head." Scientific
Fig. 4.6 H. H. King patented this shower in 1847
American called Joseph Mansfield's 1858 patent "one of the most economical and portable shower baths." Mansfield's shower consisted of a tall column divided into separate water chambers, two of which were connected by an air pipe (Fig. 4.7). When the bather opened the cock of the shower head, a layer of air in one of the chambers pushed water out of the head, setting up a repeated vacuum that set an air-pressure-propelled water flow in motion.53

It would be easy to dismiss these devices as the products of eccentric minds, but it makes more sense to see them as the products of inventors seeking to claim their share of a perceived market. In one form or another, these showers provided consumers with greater bathing convenience and flexibility; for the most part they could be used with or without a bathing tub, and filled by hand or with piped water. Shower prices are difficult to determine, since plumbers' catalogs generally sold only shower heads, rather than complete shower packages.54 The lack of complete showers may mean that people who used showers simply installed a cistern above or near their bathing tubs and piped water from it to a shower head above the tub, an arrangement that any plumber could easily construct.55 But the fact that plumbing supply houses sold shower parts, and that inventors created such a variety of shower types, reinforces the notion that Americans treated these fixtures as devices that served the final goal of achieving convenience: each individual, and each family, defined convenience differently, and manufacturers served the market best by providing fixtures in as wide a variety as possible.56 Moreover the large number of patents granted for not just for showers but other fixtures as well is indicative of the nationwide interest in plumbing as part of national
Fig. 4.7 Patent application illustration for the Mansfield shower bath, 1858
improvement: at mid-century Americans flexed their inventive muscle and ingenuity in search of technologies that met the needs of a progressive and modern people. Plumbing had not yet become a matter of mandated public policy, as it would by the end of the century, but citizen interest in progress demanded—and got—a host of fixtures with which to increase domestic comfort and ease.

**Boilers and Hot Water Systems**

A hot water system added to the convenience derived from bath tubs, showers, and other fixtures. Plan books published during the mid-century decades routinely mentioned hot water boilers. One of the first, John Hall's 1840 collection of house plans, included several references to hot water technology, and by 1878 James Bayles felt no obligation to devote much space to the subject in his survey of plumbing and drainage practice. Its principles, he noted, were "generally well understood," and its practice "present[ed] few difficulties".

The manner of providing hot water changed somewhat during the period. In 1840 Hall described a hot water supply that depended on heated coils. He explained that in a hot water cistern at the back of the kitchen fire-place ... is a coil of leaden pipe, one end of the pipe communicating with the cold water cistern above, and the other with the bath. By turning a cock in the bath room the water descends from the cistern under the roof, is heated in passing through the coil of pipes behind the kitchen fire, and ascends, by the pressure of the atmosphere on the [attic] cistern, to the bath.

The boiler and water back circulating hot water system became more common later in the period. It had three parts: a set of pipes to carry the water, a water back, and a boiler. The inaptly-named boiler only stored water; all the actual heating took place in the water back, an iron container attached to a cooking range whose fire provided the
heat. The process of generating hot water began in a cold water supply pipe that entered at the top of the boiler and ran down to within a few inches of the boiler bottom. A second pipe inserted at the base of the boiler carried the cold water to the adjacent water back for heating. As the water heated, it sought an outlet which it found in a third pipe, located at the top of the back, that carried it back into the boiler, but at a point higher than where it had entered as cold water. Finally, a discharge pipe atop the boiler carried the water throughout the house to the fixtures—tubs, sinks, and basins—where it was needed. Turning a handle at a washbasin released hot water, and as the water flowed out of the boiler, through the pipes, and into the basin, more cold water replenished the boiler's supply, pushing a new supply of cold water into the water back, which in turn pushed hot water into the boiler and on through the pipe. The circulating system had two advantages. First, the water began cooling as soon as it left the water back, but the constant circulation continually pushed very hot water on into the pipes, and forced tepid water back into the boiler where it could be reheated. Second, the steady circulation of water ensured that hot water always stood ready in the pipe; the user did not have to turn the faucet and let cold water drain out first.

The system's drawbacks balanced these advantages: during winter months, water pipes often froze, shutting off the flow of water. When that happened, the hot water no longer had an outlet and the boiler sometimes exploded. Blocked lines also contributed to boiler collapse. When anything blocked the cold water line, the boiler stayed hot as long as the water back continued to supply hot water. But when the line was unclogged, cold water poured into the boiler, turning the hot water to
steam, and causing the boiler walls to collapse. The water back also presented problems. If ice or accumulated ash or soot clogged its pipelines, a head of hot water built up and eventually ruptured the back, the boiler, or both.64

Connecting the Parts: Pipes and Faucets

In 1869 a *Scientific American* article lamented that "a material for water pipes, cheap, durable, and capable of resisting the chemical action of all waters fit for household use is a long sought for desideratum. Until it is found we must do the best we can with such materials as we possess."65 In the middle decades of the century, those materials were lead, iron, and copper, each of which had specific qualities that made it suitable for some, but not all, uses.

Lead proved to be the most popular of the three, largely because of its low cost and malleability, rather than because of any inherent superiority.66 Plumbers used lead pipes to carry water from wells and cisterns to pumps, basins, and other water fixtures, and to convey sink and bath wastes to drains and cesspools. At mid-century many Americans recognized the health risks associated with lead, but plumbers appreciated its low cost, and lead’s malleability facilitated the task of fabricating pipes.67 But the advantage of malleability had its price: as one writer noted, "with the exception of ease of working, lead cannot be said to possess qualities which adapt it for use as a material for service pipes. Lead pipe is heavy and weak; it readily stretches and sags or buckles when exposed to variations of temperature; it is easily crushed; rats can cut it without difficulty, . . . and many kinds of water attack, corrode and are poisoned by it.68

Plumbers used a variety of installation techniques to counteract these disadvantages. Because lead reacted to temperature changes, advice
manuals recommended using loose fitting fasteners that allowed lead to expand and contract without having the fastener dig into the pipe. Lead's softness caused pipes to sag unless they were well supported, so manuals urged people to hang pipes vertically rather than horizontally, or to lay them on some sort of shelf, rather than hang them from brackets.69

Iron offered greater strength than lead, but it was less malleable, and therefore harder to work with, and like lead, it, too, corroded and leaked.70 Plumbers typically used iron pipes to convey water closet wastes, calling the conduits "soil pipes" to distinguish them from other drain pipes. Even before the dangers of so-called sewer gas caused near-universal hysteria among plumbing users, Americans believed that human wastes from the water closet or privy should travel through the most secure material possible in order to prevent the release of odors and gases. In many cases, then, water closet soil pipes were made of iron, which was less likely to expand, sag, or crack than pipes made of lead.71 Copper cost more than either lead or iron, but it held up to hot water much better than lead, so plumbers used that material in the pipes attached to hot water boilers and water backs.

In practice, however, plumbers and architects used these three materials in a variety of combinations. For example, in a house built in 1840 cistern water traveled to the house through a "water trunk of zink" [sic], but lead pipes connected the well with the sinks.72 Sloan sometimes specified only that "suitable" pipes or ones "extra strong, and of sufficient size" be used, but in one set of plans he specifically directed that lead pipes carry water from the cistern to all fixtures, and in another set he used iron for the soil pipe.73 George Woodward
used a wide variety of pipe materials in specifications attached to his published plans. In one house, for example, he created a soil pipe network that combined pipes made of iron, cast iron, and lead, but elsewhere in the house he used lead for the supply and waste pipes, and brass and copper for the hot water pipe system.74

Pipes connected fixtures to each other and to a water supply, but the faucet made the water available and the fixtures useful. The faucet served two purposes: it channeled liquid into a receptacle, such as water into a sink, and it allowed users to turn a liquid's flow on and off.75 In the mid-nineteenth century, Americans generally used two types of faucets, the difference between them being the mechanism inside, one the so-called "ground cock," and the other the "compression cock." One inventor summarized the difference between the two when he described the latter as a "class of cocks in which a valve and seat take the place of the more customary taper chamber and perforated plug, . . ." found in the former.76

Indeed, ground cocks, which some patents referred to as the "customary" or "common" faucet, functioned by virtue of having parts that "ground" together in a close fit (Fig. 4.8).77 The ground cock typically consisted of a metal stem with a hole bored through its center; this stem was attached to the faucet handle and sat perpendicular to the faucet's pipe and the flowing water. Turning the handle one way aligned the stem's hole with the water passageway; turning the handle the other direction moved the hole out of alignment and shut off the flow of water. The ground cock had few moving parts, but its design had drawbacks. First, the bored stem was often cone-shaped and the tip nested in a similarly shaped seat in the faucet body. Unless these two
parts had been ground to a perfect fit, the faucet leaked constantly. Second, leaks also developed when grit, dirt, or metal particles collected between the seat and the stem and destroyed the requisite tight fit; when that happened, as one writer noted, "there [was] no remedy but to get a new faucet."\textsuperscript{78}

The compression cock had drawbacks of a different sort. Unlike the relatively simple ground cock, the compression cock consisted of many working parts. The different types of compression cocks on the market shared the same general working principle: a turn of the handle moved a valve up and down off its seat and thereby either released or stopped the flow of water. These faucets varied in detail, but they shared a multiplicity of moving parts, including handles, screws, valve stems, gaskets and flanges to prevent leakage within the valve case,
cams, lift pins, and of course valves, which ranged from little more than a metal plate that acted as a stopper in the water pipe, to rubber plugs or valves propelled by an "eccentric" cam. Packing fabricated of leather, "india rubber," or felt ensured a tight fit among all the parts, and absorbed the shock of water hammer, the phenomenon that occurred when the entire force of an abruptly-halted water column slammed into the cock and pipe. A column of water, noted one inventor, "strikes with almost as much force as would a solid column, of the same specific gravity and length," adding that "such blows will in a short time burst pipes that would otherwise last for years."79 Indeed, the compression cock offered one distinct advantage over its rival: thanks to the valves, the compression cock stopped the flow of water gradually, allowing its users to establish a water flow somewhere between merely "on" or "off." Gradual closure eliminated, or at least alleviated, water hammer.80

Inventors of both types of faucets produced devices specifically designed to compensate for plumbing problems such as water hammer and the chronic problem of frozen and cracked pipes. In 1854 Bostonian O. C. Phelps patented a simple ground cock; turning the handle aligned a hole in the plug with the flow of water through the pipe. Phelps noted that during exposure to "extreme cold" a faucet plug was "liable to be forced too far into its socket and become jammed therein". He tackled this problem, and that of water hammer, by designing the faucet so that the plug landed on a small flange or ledge that prevented it from sinking completely into its socket or seat. At the base of the seat he placed a small rubber plug, thereby creating an air pocket that absorbed the shock produced by water hammer.81
Plumbing users also had to contend with the adverse effects of hot water on faucet mechanisms. John Sheriff noted in his 1849 patent application that "the erosive action of hot water very soon renders the ... stopper, and its seat, irregular," causing leaks and water waste. Sheriff claimed that his patent not only solved that problem, but also eliminated expensive machining. His compression cock used a wooden valve, which, he argued, had the advantage that when it wore out "any ordinary workman [could] readily cut out from a board another piece to replace it." Albert Fuller's patents for compression cocks with rubber plug valves were perhaps more typical. He obtained an 1855 patent for a faucet in which turning the handle pushed the plug away from its seat, allowing water to pass freely; another turn of the handle pulled the plug back tight against the seat closing the passageway. In 1859 Fuller modified this design by sheathing the rubber plug in a metal casing, conceding that an exposed plug held up badly in a hot water faucet.

In 1860 James Flattery patented a faucet designed to alleviate both water hammer and boiler problems (Fig. 4.9). He attached a diaphragm of "india rubber, or other suitable substance" to the top of the valve stem, so that the handle's base butted directly against the diaphragm rather than the valve stem itself. Screwing the handle downward pushed against the diaphragm and stem and opened the valve, letting water flow through. Turning the handle the opposite direction immediately removed any downward pressure on diaphragm, stem, and valve, so that the pressure of water pushing upward closed the valve; the flexible diaphragm absorbed the shock. In addition, Flattery claimed that his design alleviated the dangers associated with boilers. If the
boiler collapsed at any time, the faucet valve opened automatically: the air pressure at the outside of the faucet's mouth would be greater than the pressure on the inside of the water pipe. With no water or air pressure to hold the valve shut, it would fall open and allow the pipe to fill with air, and thereby, in theory at any rate, relieve the pressure on the boiler and prevent its collapse.

As these examples show, the faucet improved the convenience of water fixtures: these inventors designed the faucet's internal mechanism to meet its primary purpose—regulating the flow of water—as well as a secondary one—compensating for some of the flaws of other water fixtures. The faucet's external form—its design—is also revealing; it can tell us something about the way people used plumbing and running water. For example, on many mid-nineteenth century basin cocks the "bib" or water spout doubled as the on-off handle, a less than desirable design feature if the faucet conveyed hot water. As noted earlier, when
Americans first began to use permanently-attached washbasins, they regarded them as replicas of the portable objects they replaced: a permanent wash basin complete with cold running water and faucet replaced the portable washstand with its ewer of cold water. For a cold-water basin, a faucet handle that doubled as a spout seemed both logical and efficient: the handle never became hot, and after filling the basin, the user turned the water off by pushing the handle to one side (fig. 4.10). Presumably the addition of hot water to the plumbing system highlighted the design's drawbacks, but in an 1878 survey of plumbing fixtures, writer T. M. Clark claimed that because of the con-
venience of the movable handle, Americans still "very generally used" what he called "swing cocks," which may mean that many people did not use hot water in their basins. 86

Unlike basin faucets whose curved spouts extended out over the bowl, some faucets had a straight pipe-like body that terminated in a threaded end to which hose could be attached. An attached hose increased kitchen convenience: large households meant larger meals, and large pots and pans that may not have fit easily into a sink. Trying to scrub a large pot in a sink is, as anyone who washes dishes knows, an awkward and messy task; a hose attached to a faucet made the job easier. A length of flexible hose certainly facilitated the task of filling buckets, ewers, pots, and portable wash tubs, and alleviated on "the toil of lifting heavy weights, and the annoyance of drenched floors." 87

Bathing tub faucets, unlike basin faucets, had very short curved bibs. Plumbers usually attached the faucet handles above the tub, but placed the bibs near to the bottom. What purpose could be served by putting the faucet down in the tub itself, near the bottom? According to an 1853 patent application

It is desirable that the cold and hot water be introduced horizontally or nearly so, at or near the bottom of the tub and near to each other not only to insure the proper admixture of the cold and hot water, . . . but, what is also very desirable to avoid splashing and noise. 88

Moreover, it is possible that people only ran a few inches of water into the tub, which would go a long way to explaining why so many regarded bathing as cruel to the system. Finally, if filling a copper or tin-lined tub was a noisy activity, it may have been modesty that led people to conceal their activities. By the 1860s, bath tubs often included an overflow mechanism, which could mean that people expected to fill tubs
to the top, but as late as 1878, T. M. Clark noted that people still preferred the faucets near the bottom, since this diminished the noise made while filling the tub, so as not to disturb people in adjacent bedrooms. 89

As this chapter has shown, mid-century houses could and did contain a variety of water fixtures. The nationwide interest in plumbing fixtures as a part of convenience and domestic improvement spurred a wave of inventive productivity as demonstrated by the large number of fixture patents issued after 1840. For the most part these patents constituted "improvements" on some existing or common device: patents offered "improved" showers, or "improved" on the "usual" faucet or bathing tub. Inventors rarely patented anything startlingly new or original in totality. Instead, they treated the existing form of water fixtures, both permanent and portable, as a collection of objects to be altered and made better, to be made more "American." The ones discussed here were supply fixtures: people put water in them in order to perform a specific task. Whey they were finished, they drained the water, which was now waste. The water closet, one of the most useful, if not troublesome and controversial, fixtures in the house should more properly be seen as a waste fixture; its sole purpose was to capture and contain wastes. For that reason, and because they are so different from the fixtures discussed here, water closets deserve their own chapter.


3For personal bathing it seems most likely that people without any other sinks, dry sinks, or permanent washbasins, would use a small portable washtub with pitcher and bowl.


6Catharine E. Beecher, A Treatise on Domestic Economy for the Use of Young Ladies at Home, and At School (Boston: Marsh, Capen, Lyon, and Webb, 1841), 282.


Catalogs used in this study came from either the Library of Congress or the Trade Catalogs at Winterthur microfiche collection. The latter includes few catalogs for the pre-1870 period and at the Library only a five catalogs for the period could be located.

William L. Schoener and Co., *Illustrated Catalogue and Price List of Plumbers' Brass Work* (New York: Sackett and Cobb, 1860), 62; Abendroth Brothers, *Plumbers' Price List* (New York: Nesbitt and Co., [186-]), 2, 7, 11, 48; J. and H. Jones and Co., *Brass Cock Manufacturers, and Importers of Plumbers' Earthenware, Illustrated Catalogue* (n.p. [1867]), 140, 145. Jones Company sold a variety of plumbers' hardware, including iron sinks, as well as imported "plumbers' earthenware" sinks, sold with or without "patent overflows." Unfortunately its 1867 catalog did not list prices, although it is safe to assume that these items would have been more costly than domestically made cast iron sinks.

Abendroth Brothers, *Price List*, 5, 7. Similar items are shown in Jones and Co., *Catalogue*, 140, 147.


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16 IGcontract, Rogers house.
19 Abendroth Brothers, Price List, 17-18.
21 Industrial Chicago: The Building Interests (Chicago: The Goodspeed Press, 1891), 53. This section of the book's text is in quote marks, and may be part of an 1888 paper by Chicago plumber David Whiteford entitled "A Quarter Century of Plumbing in Chicago."
22 Most house plans show rooms labelled "chamber," which, in light of the lack of any other appropriately labelled rooms, were apparently the "bedrooms." However, some plans, (see Ranlett), show bed rooms inside of chambers. Perhaps, then, the chamber was a multi-purpose room. If so, then it does not seem so odd that the wash-stand would be located there, rather than in another separate room. The shift of the wash basin out of the bedroom occurred later; house plans showing the basin and bathing tub in the same room did not appear in any great numbers until the 1870s and later, although some plans did show the combination earlier. Discussions of the appearance of the permanent washstand in the bedroom and its subsequent movement to the bathroom are in Bainbridge Bunting, Houses of Boston's Back Bay (Cambridge: The Belknap Press of Harvard University Press, 1867), 137, 277; Charles Lockwood, Bricks & Brownstone: The New York Row House, 1738-1929. An Architectural and Social History (New York: McGraw-Hill Book Co., 1972), 186, 188. Some plans that show the washstand located in the bathing room are Sloan, Model Architect, 1:52 and Plate XL; Sloan, City and Suburban Architecture, Plates 33, 51, 75, 81, and 112; Sanford E. Loring and W. L. B. Jenney, Principles and Practice of Architecture (Chicago: Cobb, Pritchard and Co., 1869), Example C-Plate 2; Example D-Plate 2; Example E-Plate 2; Example K-Plate 1, Example Q-Plate 3; Woodward and Thompson, Woodward's National Architecture, Plate 3 and p. 14; Andrew Jackson Downing, Cottage Residences; or, A Series of Designs for Rural Cottages and Cottage Villas, new ed., ed., George E. Harney (New York; John Wiley and Sons, 1873), 194; Bicknell, Bicknell's Village Builder, Plate 2 and specifications, Plate 4 and specifications, Plates 19 and 22.
23 Plans that showed washstands in the "chambers" or bedrooms are Sloan, Model Architect, 1:43; Orson Fowler, A Home for All or the Gravel Wall and Octagon Mode of Building, rev. and enl. (New York: Fowler and Wells, 1856), 132; J. H. Hammond, The Farmer's and Mechanic's Practical Architect; and Guide in Rural Economy (Boston: John P. Jewett and Co., 1858), 124; Sloan, City and Suburban Architecture, 27 and 47; Loring and Jenney, Principles and Practice of Architecture, Example C-Plate 2; Example D-Plate 2; Example E-Plate 2; Woodward and Thompson, Woodward's
National Architecture, Plate 28.

23Webster and Parkes, Encyclopedia, 301-303.

24Charles P. Dwyer, The Economic Cottage Builder; or, Cottages for Men of Small Means (Buffalo: Wanzer, McKim and Co., 1855), 116.


27Probably everyone agreed that cleanliness was better than filth; beyond that, however, there appears to have been considerable disagreement about what "clean" meant, how, and how often, people should bathe, and what constituted a "proper" bath": full immersion? A cold water sponge bath? A torso-only, dry-head shower bath? The best way to appreciate the extent to which Americans disagreed about bathing is to read any one of a number of journals that regularly discussed the subject, especially those associated with various health fads.

Family and Householder’s Guide; or How to Keep House; How to Provide;
How to Cook; How to Wash; How to Dye; How to Paint; How to Preserve
Health; How to Cure Disease; etc., etc.: A Manual of Household Manage-
ment, from the Latest Authorities (Auburn, N. Y.: Auburn Publishing Co.,
1859), 174-79; R. D. Mussey, Health: Its Friends and Its Foes (Boston:
Gould and Lincoln, 1862), 54-57; "Suggestions on Health," Colman’s Rural
World 19 (1867): 27; R. T. Trall, "Bathing Processes Applicable to Home
Treatment," Colman’s Rural World 19 (1867): 43; Joseph B. Lyman and
Laura E. Lyman, The Philosophy of House-Keeping: Scientific and Prac-
tical Manual for the Preparation of All Kinds of Food, the Making Up of
All Articles of Dress, the Preservation of Health, and the Intelligent
and Skilful Performance of Every Household Office [sic] (Hartford: Good-
win and Betts, 1867), 402-03; Catharine E. Beecher and Harriet Beecher
Stowe, The American Woman’s Home (New York: J. B. Ford and Co., 1869),
156-57; E. P. Miller, "Rules for Bathing," Scientific American 21


29Andrew Jackson Downing, Cottage Residences; or, A Series of
Designs for Rural Cottages and Cottage-Villas (New York: Wiley and Put-
nam, 1842), 13.

30Dwyer, Economic Cottage Builder, 115.

31Minard Lafever, The Architectural Instructor (New York: G. P.
Putnam and Co., 1856), 427.

32In the nineteenth century Americans often associated bathing
with various health fads, and with medical treatments, rather than with
cleanliness per se. See Chapter One, as well as Jane B. Donegan,
Hydropathic Highway to Health: Women and Water Cure in Antebellum
America (New York: Greenwood Press, 1986), 4-5, passim; Susan E.
Cayleff, Wash and Be Healed: The Water-Cure Movement and Women’s Health
veys of bathing fads and practices, albeit primarily from a European and
British perspective, are in Siegfried Giedion, Mechanization Takes Com-
mand (New York; Oxford University Press, 1948; reprint, New York: W. W.
Norton and Co., 1969), 659-76 (page references are from reprint edi-
tion); and Lawrence Wright, Clean and Decent: The Fascinating History of
the Bathroom and the Water Closet (New York: The Viking Press, 1960),
157-86.

For cleanliness, see Richard L. Bushman and Claudia L. Bushman,
"The Early History of Cleanliness in America," Journal of American His-
tory 74 (1987-88): 1213-38; Harold Donaldson Eberlein, "When Society
First Took a Bath," in Sickness and Health in America: Readings in the
History of Medicine and Public Health, eds. Judith Walzer Leavitt and
338-40; Jacqueline S. Wilkie, "Submerged Sensuality: Technology and Per-
Suellen Hoy is currently working on a history of American cleanliness
tentatively entitled Chasing Dirt: The American Pursuit of Cleanliness
(forthcoming, The Free Press.)
33City of Boston, Cochituate Water Board, Report of the Cochituate Water Board, to the City Council of Boston, for the Year 1853 (Boston: J. H. Eastburn, 1854), 52; Report of the Cochituate Water Board to the City Council of Boston, for the Year 1860 (Boston: George C. Rand and Avery, 1861), 29; Report of the Cochituate Water Board, to the City Council of Boston, for the Year Ending April 30, 1871 (n. p., n. d.), 66.

34Cambridge, Mass., Water Board, The Seventh Annual Report of the Cambridge Water Board to the City Council, Together With the Reports of the Registrar and Superintendent, and Other Documents, for the Year 1871 (Cambridge: Riverside Press, 1872), 18; Baltimore, Water Department, Annual Report of the Water Department of the City of Baltimore, to the Mayor and City Council of Baltimore (Baltimore: James Young, 1863), 11; Annual Report of the Water Department of the City of Baltimore, for the Year Ending December 31st, 1869 (Baltimore: Kelly, Piet, and Co., 1870), 28.

35John Hall, A Series of Select and Modern Designs for Dwelling Houses, for the Use of Carpenters and Builders, 2d ed. (Baltimore: John Murphy, 1840), Plates 4, 5, 6, 7, 8, 10, 11, 13, 16, 21, 22; descriptions of the hot and cold water supply arrangements are on pp. 10, 12, 18, 27.

36 Good descriptions of early nineteenth century portable tubs are in Bushman and Bushman, "Early History of Cleanliness," 1215 and 1225.

37 Lafever, Architectural Instructor, 427.

38 It is possible that Americans favored second floor bathing rooms that held a tub only because of their perceptions of "public" and "private" spaces within the home. People may have expected guests to use a washbasin, but no one expected the afternoon visitor or casual caller to use a bathing tub, an object reserved for the family alone; thus it made sense to put a basin in a small closet or "lobby" on the first floor, but the bathing tub in a quite separate, and private, room. For a discussion of public and private household spaces see Clifford E. Clark, Jr., The American Family Home, 1800-1960 (Chapel Hill: The University of North Carolina Press, 1986), 40, 42-43. Clark also notes the mid-century obsession, which extended to the home, of assigning specific rooms to specific purposes; see p. 40.

At any rate, during these two decades, few of the house plans surveyed had a first floor bathing room: a Toledo, Ohio, house of two stories and numerous bedrooms had a bathing room located off of and accessible only through a first floor bedroom. A Troy, New York, house also included a first floor bathing room, as did the water supply plan included in Catharine Beecher's Treatise on Domestic Economy. The second floor "bathroom" containing a tub, basin, and water closet appeared more frequently beginning in the 1860s. For first floor bathing rooms see Cummings and Miller, Modern American Architecture, text following Plate 3, text preceding Plate 4, text following Plate 13; Beecher, Treatise on Domestic Economy (1841), 292-93.

39 During the 1840s and 1850s, Americans separated the tub and the water closet; by all accounts the water closet tended to smell, so for that reason alone it made sense to isolate it from other fixtures. The house plans that show the two together tend to be ones published later in the mid-century period, but see Vaux, Villas and Cottages, 189, 193, 212, 246, 259, 290. Also see Riddell, Architectural Designs, Villa 4; Woodward and Thompson, Woodward's National Architect, Plate 43; "A Suburban Villa," Architectural Review and Builders' Journal 1 (1868-69): 750; "A Model Cottage," Architectural Review and Builders' Journal 1 (1868-69): 749; Chamber Story Plan, H. Abercombie house, Braintree, Mass., 1859-60, Luther Briggs, Architect, Drawer 5, File 7, Sheet 4, Society for the Preservation of New England Antiquities.


41 Sloan, Model Architect, 1:15; also see 1:14, 43, 52, 2:97.

42 Ranlett, City Architect, 16; Riddell, Architectural Designs, General Directions for Design No. 11, but also see Designs 13, 15, 16.


For specifications that called for copper-lined tubs see Sloan, City and Suburban Architecture, 27, 47; Woodward and Thompson, Woodward's National Architecture, 14, 31, 44; Bicknell, Bicknell's Village Builder, Specifications for Plates 2, 3 and 4; Hallett, Specifications for Frame Houses, 30; Bicknell, Supplement to Bicknell's Village Builder (New York: A. J. Bicknell and Co., [1871]), n. p., specifications for Design No. 1.

Based on the text and illustrations in these catalogs it is difficult to make out just what the houses offered in the way of copper tubs. The pictures show a rectangular frame, but it is not clear if the item being sold was merely a copper tub-shaped object to be set into a wooden frame during installation, or the copper tub shape plus a copper rectangular frame; typically catalog texts described the item only as a "copper tub."

According to one source, the shower bath "was never used in water-cure processes." See Cayleff, Wash and Be Healed, 37.

It is not clear what the water board meant by an "attached" shower, but such a device may have been nothing more than a shower head attached to one of the tub faucets. 1858 was the last year in which the Board included the notation about attached shower baths; thereafter the Registrar merely counted the showers in tubless houses, a number which stood at 736 in 1869. See Boston, Cochituate Water Board, Report of the Cochituate Water Board to the City Council of Boston for the Year Ending April 30, 1870 (n. p., 1870), 57.


54 See for example, Jones and Co., Catalogue, 71, 129. Willard and Naylor sold "plain" shower heads, copper or brass, for $13.33 per dozen, and "fancy" heads at $20.00 per dozen. See Willard and Naylor, Catalogue, 77.

55 Minard Lafever claimed that a shower could be "easily arranged above the bathing-tub, receiving its water from the small cistern provided for the water-closet," but since the w. c. in most houses was situated far from the bathing room, his was a suggestion of dubious practicality. Lafever, Architectural Instructor, 427.

56 There is some evidence that plumbers made showers to order: according to one source, mid-century plumbers fabricated "artistically designed 'showers'" in the shop. "This shower was considered a masterpiece of work, and on it the older apprentices were selected to try their hands. Great pride was taken by the workmen to make the joints of solder look bright and clean." See Industrial Chicago, 50.

57 A house could have two boilers, one for hot water, and another "wash boiler" used for washing clothes. The discussion here focuses on the former, rather than the latter.

58 Hall, Modern Designs, 20; James Bayles, House Drainage and Water Service (New York: David Williams, 1878), 122. For some built houses that had hot water see Hall, Modern Designs, 18; Brown, Carpenter's Assistant, 132; Sloan, Modern Architect, 1:52; Fowler, A Home for All, 132; Duggin, "How to Build Your Country Houses," 38; Riddell, Architectural Designs, specifications for Design No. 11; Holly, Holly's Country Seats, 52, 98; Woodward and Woodward, Woodward's Architecture and Rural Art, No. 1, 88; "Lake Shore Villa," American Builder 1 (1868): 107; Lockwood, Bricks and Brownstone, 183-84.

Contracts, specifications, and drawings held at the Society for the Preservation of New England Antiquities: Specifications, D. and L. Bowman house, c. 1840, Box 3, Folder 15; First Story Plan, 4 Court St. house, [Boston], 1848, Luther Briggs, Architect, Drawer 5, sheet 5; Specifications and Contract, Gideon F. Thayer Reed house, Canton, Mass., 1848, Charles E. Parker, Architect, Box 3, Folder 14; Contract, Rogers house, 1852; Plan, James H. Beals house, Boston, 1852, Gridley Bryant, Architect, Drawer 4, File 6; Principal Story Plan, Bigelow house; Prin-

59 Hall, Modern Designs, 27. An "old plumber" also described this type of coil heating system as being typical in New York houses in 1840. See Felix, "Talk With An Old Plumber," 525.

60 A discussion of the water back and problems associated with it is in Goodholme, Domestic Cyclopaedia, s. v. "Water-back." Also see U. S. Patent 19,368, J. Ingram, "Water-back for Ranges," 16 February 1858.

61 For a view of a boiler see Bunting, Houses of Boston's Back Bay, 278; [Gardner Chilson], Gardner Chilson, Inventor and Manufacturer of, and Dealer In Heating, Cooking, and Ventilating Apparatus of Every Description (Boston: Damrell and Moore, [1851]; Winterthur Trade Catalogs, microfiche collection. Item 1516, card 1), 40.


66 In the 1840s and 1850s Americans debated the use of lead for water storage and water pipes, some arguing that the combined action of water and air created a possibly dangerous reaction on and near a lead surface. The debate over the affect of lead upon water focused on the so-called "doctrine of protective power"--the belief that water contained impurities that would, over time, create an "insoluble, impervious coat" on any lead surface such as the inside of a pipe or cistern. This coating, proponents argued, prevented the lead from tainting the water. Quotation is from Horatio Adams, "On the Action of Water on Lead Pipes," Transactions of the American Medical Association 5 (1852); 169. The debate about the safety of lead for the conveyance of water continued throughout the mid-century period; for a formulation of the issue in the early 1870s see "Iron versus Lead Pipes," Technologist 2 (1871): 277-78.

For other discussions see Webster and Parkes, Encyclopedia,
In the early nineteenth century plumbers formed pipes by wrapping and beating lead sheets around iron or wooden cores, and soldering the joint. But during the first half of the century inventors began mechanizing the process of pipe production pipes by forcing softened lead through the space between two concentrically arranged cylinders, drawing out pipe lengths much as wire was drawn.


Bayles, House Drainage and Water Service, 105.


As an alternative to lead and iron pipes, people experimented with ways to line pipes with either tin or zinc. It proved difficult to spread the lining evenly and thoroughly over the pipe’s surface, and even when the coating was applied perfectly, some types of water still "attacked" and destroyed the pipe.

Mid-nineteenth century Americans found the odors associated with water closets and privy vaults as distasteful as one might expect; they did not, however, find them especially fearsome, certainly not to the extent that Americans did in the late 1870s and 1880s. For example, the "trap" would eventually become an object of great importance in preventing the deadly sewer gas, but at mid-century Americans referred to this device as a "stench-trap" because its job was to hold back offense odors, which were of far greater concern to them than deadly gases. See, for example, Ranlett, The Architect, 2:39; "Keep the Premises Clean," Valley Farmer 3 (1851): 276; Sloan, Model Architect, 1:58-59; Jacques, The House, 55; Hammond, Farmer's and Mechanic's Practical Architect, 151; Henry W. Cleaveland, William Backus, and Samuel D. Backus, Village and Farm Cottages. The Requirements of American Village Homes Considered and Suggested; With Designs for Such Houses of Moderate Cost (New York: D. Appleton and Co., 1856), 144-45.

Specifications, D. and L. Bowman house.

Sloan, City and Suburban Architecture, 27, 47; Sloan, Model Architect, 1:43, 2:97.

Woodward and Thompson, Woodward's National Architect, 30, but also see Designs 1, 6, and 17. For other descriptions of pipe material used see Fowler, A Home for All, 132, 147; and at the Society for the Preservation of New England Antiquities: Specifications and Contract, Griggs house; Contract, Rogers house; Contract, Sarah D. Bird house, Brookline, Mass., 1858, Box 3, Folder 13A; Specifications, Adams Daniels house.

The terminology of mid-nineteenth century faucet technology is confusing. Patent applications used the terms "faucet," "stop-cock," and "globe valve." "Faucet" referred to the general category of devices that regulated the flow of a liquid, whether it was beer, molasses, or water; "stop-cock" usually referred to a device that regulated the flow of liquid within and between two pieces of pipe. For example, people used a "stop-cock" to regulate the flow of water between a street main and the branch pipe through which that water entered the house. "Basin faucet," on the other hand, referred to an object screwed or soldered at one end to a supply pipe, whose other end connected to nothing; water poured out of it into a basin or sink. Finally, some inventors used the term "globe valve" to describe their patents, but this term referred not to the faucet itself, but to what was inside, namely the faucet mechanism, or valve, encased inside a globe-shaped section of the faucet. Mid-century patentees used these terms interchangeably and simultaneously. For example, Edward Sterry used faucet, globe valve, and stop-cock to describe his 1855 patent, a device with a turn-key handle that used a lifting valve to shut water on and off. Similarly, Isaac Tate referred to his 1860 patent as both globe valve and faucet, and John Griffiths used globe valve, valve-cock, and stop cock to describe his 1854 patent. Tate's invention used a leather diaphragm, spring, and lift valve, while Griffiths patented a lift valve that regulated water flow between two sections of pipe. All three, however, were designed to be used on a sink or basin. See U. S. Patent 4,022, Edward A. Sterry, "Faucet," 122 June 1855; Patent 28,699, Isaac C. Tate,


In fact it is quite difficult to determine just how widely it was used. Illustrations of the merchandise in plumbers' catalogs did not show the inside mechanisms, so that from diagrams alone it is impossible to tell what kind of cocks were sold. See Naylor and Willard, Catalogue, 6, 11, 15, 38; Schoener and Co., Catalogue, 18-20; Jones and Co., Catalogue, 12, 72-74, 80, 90-91, 101. According to one source, in mid-century Chicago the "cock in use . . . was of the ground-in pattern." See Industrial Chicago, 49.


For a good survey of the various types of faucets see Clark, "Faucets," 180.
86 Ibid., 180. Clark also noted that plumbers preferred faucets with a fixed handle that was separate from the spout.


88 U. S. Patent 10,049, Jordan L. Mott, "Bathing-Tub, 27 September 1853. Often a sheet of lead covered the floor beneath tubs, basins, and water closets, but it is not clear that any of the rest of the room was protected against water. See Clark, "Wash-basins.-Pantry Sinks.-Filters.-Bath-tubs," 40; Specifications, H. B. Rogers house.

89 Clark, "Faucets, 180; Clark, "Wash-basins.-Pantry Sinks.-Filters.-Bath-tubs," 39.
Before 1850 the United States patent office issued just three water closet patents. Americans had certainly known about and used mechanical closets before the 1850s, albeit in small numbers, but they apparently used either simple devices for which no patent had been obtained, or one of the many British and French closets that were available. The British patent office in particular issued numerous patents for closets during the eighteenth and early nineteenth century, and there was no shortage of models from which to choose.\(^1\) Indeed, starting in the 1850s American inventors produced a flood of mechanical and portable water closets, as well as improvements in the privy.\(^2\) During the 1850s and 1860s American inventors and plumbing supply houses all but ignored existing European and British devices, preferring instead to produce and sell models invented and manufactured in America. This wave of invention should not be seen as simply a random burst of American ingenuity; instead, it seems to indicate, first, an acknowledgement of specifically "American" needs, and thus, second, a rejection of British and other European water closets as unsuitable for American use. By the late nineteenth century, when the "modern" "sanitary" flush toilet appeared on the scene, these mid-century devices were brushed aside, regarded now as primitive technological deadends hardly worthy of discussion.\(^3\) But the business of designing, making, and using water
closets was alive and well in America by the 1850s, well before the advent of mass-produced porcelain sanitary ware and the introduction of the porcelain flush toilet. This chapter examines mid-century mechanical water closets, as well as the other devices contemporaries used to dispose of human wastes.

### Water Closets and Privies

During the middle nineteenth century, Americans used three kinds of technologies for human waste disposal, two of which they referred to as "water closets": the "dry" privy, the simple outhouse over a pit; a non-mechanical but water-based "privy," in which wastes fell into a vault and water flushed them into a drain; and the water-based mechanical flushing device most commonly associated with the phrase "water closet." That "modest mansion of retirement," the dry privy, requires little discussion; it was simplicity itself, and possibly the most numerous of the three. The non-mechanical water closet was more complicated. It consisted of an enclosure—a closet—with one or more seats atop a brick- or stone-walled vault. Wastes fell directly into the vault, but unlike the simple dry privy, a water supply of some type regularly flushed the vault clean. Pipes attached to the vault carried wastes away to a cesspool or other receptacle (such as a public sewer when that was available.) In other words, in a privy, wastes accumulated until removed by excavation, but in the water-based privy, water regularly washed or "flushed" the vault free of its accumulations. This type can best be illustrated by looking at two examples.

In the Rutherfurd [sic] Park, New Jersey, house shown in one of George Woodward’s plan books, the "water closets" sat side-by-side at the back of the house (Fig. 5.1). Under them the contractor dug a five
Fig. 5.1 Plans for the D. L. Evans house, Rutherfurd Park, New Jersey, as shown in Woodward’s National Architect
foot deep vault, which he finished off with an eight-inch thick brick wall. A six-inch pipe connected this vault to the household cesspool, located some distance away. Two tin leaders channeled roof runoff and rain water into the vault, providing the water necessary to flush the wastes out of the vault and into the drain pipe leading to the cesspool. Unfortunately the specifications are less clear about the closets themselves, since they only ordered the builder to "fit up the two W. C.'s with risers, seats and hinged flaps, the seats and flaps of hard wood." Since the other builder’s specifications included in Woodward’s book specifically designated the type of water closet to be installed, it seems reasonable to conclude that in this house the "water closets" consisted simply of seats perched above a vault flushed by a stream of water.

The second example comes from an 1856 publication by Calvert Vaux. As noted in Chapter Two, Vaux regarded the water closet "or its equivalent, [as] an absolute necessity" in any "convenient and agreeable house." To alleviate the "difficulty" and expense associated with a "regular water-closet," he designed, and installed in some of his clients’ houses, an alternative waste-disposal arrangement that used running water but no mechanical flushing mechanism (Fig. 5.2). Vaux’s "necessary" either abutted or sat next to the house and consisted of a small closet-like space with a seat inside. Wastes fell into a small enclosure or "receiver" located under the seat. A supply pipe attached to the roof eaves funneled rain and snow runoff into one side of the receiver; a second pipe on the receiver’s opposite side carried wastes away connected to a drain and cesspool. Vaux noted that a device like this provided the convenience of flushing, as opposed to manual removal.
Fig. 5.2 This "necessary" designed by Calvert Vaux had no mechanical parts of wastes, without the bother and expense of mechanical water closets (which are described later in this chapter); this non-mechanical alternative, he noted, was applicable to any house in any situation, and can hardly get out of order . . . for . . . there is nothing to burst, and no evaporation takes place in very cold weather; while . . . if a long drought occurs . . . , a few pails of water poured in . . . will set matters right till a shower comes."⁶

These examples suggest two ideas. First, mid-nineteenth century Americans regarded the presence of water, rather than a mechanical flushing device, as the factor that defined some privies as water closets; as one advice manual explained, a water closet was "a privy, supplied with a stream of water, or water pipe, to keep it clean."⁷
Americans defined a "water closet" as any one of a number of devices that used water to flush human wastes, but all water closets fell into the category of "privies" or "necessaries." This manner of defining the water closet explains why Americans sometimes used the terms water closet and privy interchangeably. Second, and perhaps more importantly, during the mid-nineteenth century Americans demonstrated an interest in improving upon, reforming if you will, the traditional outhouse or privy. Both of the arrangements described above offered people interested in domestic improvement a way to eliminate the unpleasant trip to the outhouse by using instead a decidedly low-cost and low-maintenance alternative. Both of these points can be seen by looking at some contemporary house plans.

William Ranlett used the label "water closet" to describe a variety of spaces from outbuildings to closets on the second floor. For example, the plans for a group of four houses built on Staten Island showed that an outbuilding located behind each dwelling housed wood storage, a wash house, and two "water closets." The plans for a New York City "villa" showed a similar arrangement: a "wood house" located fifty feet behind the villa contained two compartments marked "water closet." At "Waldwic Cottage" near Paramus, New Jersey, a shed attached to the rear of the house, but accessible only from the outside, housed two water closets, while a third water closet was inside the house on the second floor. None of Ranlett’s accompanying text described the contents of these spaces, but it seems unlikely, although not impossible, that each one held a mechanical water closet, especially since most of the plans showed not one but two adjacent closets, each with at least one, but often two, holes. But in each case the "water
"Water closets" had been placed either inside the house or inside an adjacent or adjoining building, where it was sheltered from the elements and concealed from onlookers, a decided improvement over the solitary privy stationed a long (especially in cold months) distance from the house.®

Ranlett's house plans were not unusual. In his 1856 Cottage Builder's Manual, Zebulon Baker included the plans for his Dudley, Massachusetts, house and grounds. The property's outbuildings included a barn which contained a "wood room," inside of which were two "water closets. On the other hand, the home of a "young mechanic," shown in

![Diagram of house plans]

Fig. 5.3 "Water closets" in the wood shed. The Benjamin Butman house in Worcester, Mass., as shown in Brown and Joy's Carpenter's Assistant.
Fig. 5.4 A Manchester, Vermont, house with water closet in the wood shed. From Cummings and Miller, *Modern American Architecture*
the same book, also had w. c.'s inside a wood room, but in this case the structure was attached to the rear of the house. Other mid-century publications show variations on these arrangements. One house built in the early 1850s at Worcester, Massachusetts, and two built in the early 1860s at Manchester, Vermont, each had water closets located in wood houses behind the kitchen; the one shown on the plans for the Worcester dwelling multiple holes (Figs. 5.3 and 5.4). A Cold Spring, New York, house designed by architect George Harney had a two-seat water closet situated on a "private veranda" just outside the kitchen door. A New Jersey house built in the very late 1850s had three areas labelled "water closet." Two of them, each with two seats, sat back-to-back at the rear of the first floor. Users entered one of these, labelled "servant's water closet," from an entryway off the washroom behind the kitchen, and the other through a door located on an outside veranda. A third floor bathing room housed the third "water closet."

Some architects used both terms on the same plan, which may have been their way of differentiating between privies that used water and privies that used water and mechanical flushing. Architect Luther Briggs labelled closets built just off the kitchens of his houses "privies," but reserved "water closet" for spaces situated inside the house. The plans he drew for one client included a three-hole "privy inside the "wash room" attached to kitchen. The dwelling's foundation plans showed a "vault" just below the privy; a drain pipe connected the vault to the cesspool (Figs. 5.5 and 5.6). In another Briggs house, the second floor water closet wastes flushed into a drain, but a first floor privy inside the wood house drained into a vault (see Fig. 3.5). Briggs apparently regarded the privy and the water closet as two separate
Fig. 5.5 A self-contained drainage system with privy, water closet, and cesspool. Ephm. Merriam house, Jamaica Plain, Mass. Foundation Plan. Luther Briggs, Jr., Architect. 1856. Collection of the Society for the Preservation of New England Antiquities, Boston
Fig. 5.6 First floor privy. Note kitchen sink and pump and compare with foundation plan (fig. 5.5). Ephm. Merriam House, Jamaica Plain Mass. Principal Story. Luther Briggs, Jr., Architect. Collection of the Society for the Preservation of New England Antiquities, Boston
objects: a privy sat at the back of the house, and the water closet inside, but both could be connected to a drain. Sloan made the same distinction. In the plans for an "Italian villa," Sloan included a "privy" inside the house, in front of, rather than behind, the kitchen, and at the end of the main entry hallway. He placed a "water closet" on the second floor directly above that privy (presumably they shared the same drainage system) (figs. 5.7 and 5.8). For a thirty thousand dollar "villa" built near Philadelphia, Sloan placed most of the water fixtures in an octagonal bay located at one corner of the house; fixtures
Fig. 5.8 Another Sloan design. Note the water closets on the gallery drained into a brick-lined "well" located beneath the tower. The tub and cistern sat on the tower's second and attic floors, respectively; the first and basement levels held two-seat water closets with "china bowls and a soil pipe connecting with the well beneath." Clearly, then, these two closets that drained into a vault were more than just wooden benches, although it is not clear that Sloan intended the closet spaces to house mechanical flushing devices.15
Terminology from these house plans indicate that mid-nineteenth century Americans defined water closet and privy more flexibly than has perhaps been realized. Architects labelled spaces inside of barns and woodsheds as "water closets," and rooms actually inside of or attached to houses as "privies." Moreover, the closets shown on house plans often had multiple seats, a feature not normally associated with a flushing "water closet." Finally, all of these plans show this space nearby, attached to, or inside the house, indicating the general interest in making privy or closet use easier and more agreeable. Precisely where people put a water closet seemed to depend primarily on personal preference and on personal definitions of convenience. By all accounts, mid-century water closets, with or without a mechanical flushing mechanism, smelled, so not everyone enjoyed having them centrally located inside the house. On the other hand, a mechanical water closet installed next to an outside wall or in a small leanto attached to the house did not stand up well to cold weather. Advice manuals and architectural plan books weighed the advantages and disadvantages of privies versus water closets, and indoor versus outdoor water closet installation, and suggested ways for readers to maximize the convenience that a water closet of either type offered.

For example, Ranlett explained that in many households the water closet, "an important appendage to a dwelling," was "very frequently a 'privy'. . . placed in the yard or garden, separate from all other buildings, [and] sometimes ornamented with a screen, or consecrated by a miniature steeple, as if it were feared that the public eye might not recognize its use," Ranlett objected to this "most egregious lack of good taste," and offered suggestions for an improved
arrangement. Install the water closet in "a room in the main edifice or in an out building," he advised readers, but instead of a vault, place "a basin in the seat, from which a soil-pipe extends to the drain, that conveys the sediment to a sesspool [sic] . . . ." Orson Fowler urged his readers to install an "in-door 'water-closet'" for the benefit of the invalid and the aged. "And under the stairs is just the place for one, its contents passing down . . . into a receiving box in the cellar, made tight and easily cleaned, . . . and both [it] and the closet itself ventilated into an adjoining chimney." He suggested that water from a nearby cistern be used to flush the ventilating pipe in order to cut down on odors.

The author of another advice manual argued that readers ought to place that "diminutive house," the privy, outside the main house but concealed from view: "It is strange," he mused, "that a house which every one is ashamed to be seen to enter, should be so often paraded in one of the most conspicuous positions that could be found, . . . ." The practice of concealing it with a trellis or behind another outbuilding hardly constituted an improvement:

the unfortunate person who was obliged to retire to it might skulk round the shed, and allow it to be conjectured that he might possibly be gone on some less ignoble errand. . . . There was no actual proof that he entered the temple . . . ; and a modest female after having occupied it without being seen to enter it, might on coming out return to the dwelling-house with a feeling of comparative innocence.

This author pronounced the inside of the shed "the best possible location for the common privy" because "one need not expose himself to sun, wind, rain, or snow, in making his retreat thither." On the other hand, he advised readers to install the water closet in the middle of the house, "so long as it [was] in mechanical order and well supplied with a
stream of clear water." Lewis Allen disagreed. He regarded "privies, or water-closets as they are genteely called" as "an effeminacy only and introduced by city life," and strongly denounced the "fashion . . . of thrusting these noisome things into the midst of sleeping chambers and living rooms--pandering to effeminacy, . . . ." He urged his readers to attach their "outbuildings" to the house in some way, rather than separate them completely. The inconvenience of detached outbuildings situated some distance away from the house, he explained, tempted people to put inside the house "some things, which in a country establishment, ought never to be there," namely water closets. The authors of Village and Farm Cottages disagreed: "Every dwelling," they wrote, "however humble, should have a water-closet under its roof, accessible with ease and without exposure to the external air." The alternative required "the necessity of greater care, and perhaps cost, in the construction of vaults, etc," although a vault proved necessary when no sewer was available. But the authors warned their readers that imperfect installation of a water closet negated its advantages. The "right precautions," including "running water and facilities for drainage" and adequate ventilation, removed "all causes of offence" associated with the water closet. A "manual of rural architecture" also assessed the advantages and disadvantages of the water closet, and concluded that unless the household enjoyed running water and "facilities for complete drainage, the balance fell in favor of the latter. Another writer lamented that it was "a pity" that more people did not install indoor water closets because even with their flaws they were cheaper and certainly less obtrusive than an "unsightly outbuilding." An architectural plan book promised its readers that an interior water closet would be of "no
annoyance to any part of the house," when the closet was "entirely isolated," by being "surrounded by brick walls" and well-ventilated by both a window and a ventilation shaft connected to the adjacent chimney flue.23

Catharine Beecher's first housekeeping manual omitted any mention of water closets, but by the late 1860s she had weighed the merits of both dry privies and water closets, and decided the advantage fell on the side of the latter. In 1841 her ideal house included a privy with "two apartments," a weighted door that closed easily, and a window. She placed the privy behind the kitchen next to the woodpile.24 By the 1860s, however, she had come to see the water closet as a tool of real convenience: when properly installed, she announced in an 1866 essay, "no other household improvement so much promotes health, neatness, and economy of labor."25 She modified that stance slightly a few years later in *The American Woman's Home*: Beecher and her co-author Harriet Beecher Stowe instructed readers that water closets equipped with the "latest improvements" were as cheap as outdoor privies and far more convenient because the former eliminated "the most disagreeable house labor," by which they presumably meant emptying chamber pots. But, they added, when all the costs were weighed, the earth closet offered even greater advantages because unlike its water-using counterpart, the earth closet eliminated the costs of pipework and repairs.26

As these examples indicate, during the 1850s and 1860s in particular, Americans demonstrated an active interest in improving and reforming this "necessary" part of the home. They seemed to reject the traditional privy as being unworthy of American families, choosing instead to explore various practical and often low-cost alternatives.
They now claimed that the convenience provided by a water closet or privy depended upon proper placement and installation, which included adequate water, drainage, and ventilation. But both architectural drawings and texts should serve as caution signs, reminding us that the distinction between a privy and a water closet was not as well-defined in the mid-nineteenth century as it is now. The arrangements described thus far indicate that a "water closet" may have been nothing more than a seat, a vault, and a drain pipe; put another way, water, regardless of where it came from, rather than a flushing mechanism, served as a necessary first requirement for a water closet. Sometimes, of course, people used water closets that flushed mechanically, and those devices require a closer look.

**Mechanical Water Closets**

In the late nineteenth century writers distinguished among four or five different categories of water closets, but at mid-century, despite the variety of forms being produced by French and British inventors, Americans generally used just two types, the pan and the hopper (Fig. 5.9). In its simplest form, the hopper was little more than a funnel-shaped extension of a soil pipe. Gravity and a stream of water carried wastes through the funnel to the pipe, and on out of the house to a waste receptacle. Sometimes users manipulated an attached valve in order to regulate the flow of water into the hopper, although turning a simple faucet on and off worked just as well. The pan closet differed in both form and function. It consisted of a hopper funnel with a bowl-shaped seat and a catch-pan fastened atop it. The user manipulated valves, levers, and other parts in order to move water in and out, and to tip the catch pan that dumped wastes into the soil pipe. Unlike the
Fig. 5.9 Top left, a long, or Philadelphia, hopper; top right, a short hopper; bottom, a simple pan closet. Hopper diagrams from W. P. Gerhard's *Hints on the Drainage and Sewerage of Dwellings*; pan diagram from T. M. Clark, "Modern Plumbing"
hopper, whose funnel shape was integral to its function, the pan closet depended less on the shape of the vessel and more on the efficiency and reliability of the mechanisms that synchronized the actions of the water valve and catch-pan.

Neither device was brand-new in mid-nineteenth century America, but inventors treated them as objects whose older and original (and usually British or French) form was unsatisfactory and which could be improved upon in order to better serve the needs of a rapidly progressing modern American nation. Inventors tinkered with closet valves, bowls, floats, tanks, pipe attachments, and the like in order to create water closets that worked well, conserved water, required little maintenance, and smelled as "cleanly" as possible. Only the most modern of devices would suit the needs of the American family. But the distinction between the two types of closets, the pan and the hopper, had important consequences for the designers who tried to improve them. Inventors of pan closets concentrated on designing valves, flaps, levers, and the like, and on synchronizing them with each other and with the flow of water in and out of the pan. Designers of hopper closets, on the other hand, were interested less in creating complex mechanical devices, and more in using the bowl as an intermediary between water supply and water disposal. They focused their attentions on the shape and form of the bowl, rather than on any mechanical additions to it. As a result, the pan closet became more and more complex, and moved gradually toward a technological dead-end, while the hopper's path lead toward the flush toilet produced by the end of the century. That process can be seen by taking a closer look at the technology of these two devices.
Low price and simple operation accounted for the hopper's popularity at mid-century; according to one observer, both traits made it "suitable for the use of persons who cannot be trusted with the better kinds of water-closet; . . . ", by which he presumably meant the more complex, and more costly, pan closet.\(^29\) In its simplest form, the hopper consisted of a funnel that rose up out of the floor.\(^30\) Wastes fell straight into the funnel, or "hopper," and down into the trap and pipe attached to the base of the hopper. Plumbers connected the hopper leg to the trap by sliding the former into the latter; then they either puttied the joint or bolted the hopper to the trap by means of a flange. In the United States, manufacturers fabricated the hoppers of iron, and sold them plain, painted, or enamelled.\(^31\)

Hopper funnels generally had either straight or slightly bulging sides that tapered to a straight pipe-like formation at the base. Some people favored the straight sides because these provided a more direct path for wastes to follow on their way into the soil pipe. Others, however, argued that "the action of the flushing water, entering at the side and descending spirally, is more uniform if the sides of the hopper are curved . . . ."\(^32\) The choice of one over the other may have depended upon how the user supplied water to the closet: people who purchased a straight hopper probably planned to attach it to a pipe that provided just enough water to wet the sides of the hopper so that wastes would slide down into the pipe; anything more than a trickle, such as water piped under pressure, would be more likely to splash out of a straight-sided vessel than it would out of one with curved sides. Mid-century consumers could also choose from "short" and "long" hoppers.
Plumbers installed the long, or Philadelphia, hopper directly on the floor, placing its attached soil pipe and trap under the floorboards. The long hopper took up less space than the so-called short hopper, but the concealed pipe work proved harder to clean and service. In a short hopper, on the other hand, the hopper, soil pipe, and trap all sat on the floor, exposed to view. This style took up more space but its pipe work was readily accessible (see Fig. 5.9).  

The hopper had its virtues and its failings. In a comparison of water closet designs written in the early 1880s, one writer noted that the "great merit of hoppers lies in their simplicity and in the total absence of any mechanical parts, which sooner or later, fail to work properly . . . ." Another observer believed that the hopper's advantage lay in its "strength, simplicity and the impossibility of concealing filth within . . . ." Its open design and simple lines exposed accumulated filth to both eye and nose and thus facilitated the task of cleaning, which was not the case with the rival pan closet where decaying wastes lay "beyond . . . reach, and out of . . . sight". Indeed, the hopper's lack of moving parts and resulting simplicity made it a good choice for a household water closet, especially in northern climates where winter weather took its toll on delicate mechanisms. It also proved beneficial in households where servants and other less "responsible" and capable people might be using the device.

These advantages had their downside. The hopper's simple open shape provided no barrier between the contents of the soil pipe and trap, and the surrounding air, and as a result "the contents of the trap float[ed] directly under the orifice of the bowl for hours or often days at a time so that there [was] usually more or less smell from it".
Moreover, the device had to be flushed as thoroughly as possible to ensure that wastes fell into the pipe, rather than cling to the sides. But mid-century hoppers rarely had a flushing rim that channeled water all the way around the rim and sides; instead, water entered the hopper at a single point and, as noted above, in a trickle since a powerful spurt would splash out over the straight sides. This trickle kept the sides only marginally clean, and in order to keep the sides as slick as possible, people often left the water running constantly. As a consequence, the hopper had a notorious reputation for wasting water, a problem Boston's Cochituate Water Board studied in the early 1850s.

The Board reported to the City Council that the hopper closet is so constructed that a person using it must turn on a 5/8-inch stream of water, which is kept running during the time that the closet is used, and as in many instances the stream is not shut off, the water runs until a person familiar with the construction closes it. Doubtless in about one case of four it is forgotten, and the water is thus left to run to waste. This closet takes about nine times as much water to do the same service as a pan closet. The Board asked Council for permission to charge twelve dollars per year for hopper closets, and six for pan closets. This report had little impact, and in 1862 the Water Board re-opened the issue, noting with dismay that as a result of the Council's failure to adopt the earlier recommendation,

the hopper . . . closets . . . have increased about 160 per cent. The only reason that can be assigned for the great increase of the hopper over the pan closet is that they can be procured at a much less price, [and their] peculiar construction . . . will allow of their being placed in situations exposed to the cold weather, . . . in which case a stream of water can readily be allowed to run in them to prevent their freezing; whereas, the pan closet . . . is such that it must necessarily be situated in some place where they can partake of the general warmth of the house . . . .[sic] Some inventors directed their energies to the task of making the hopper closet more agreeable to municipal water boards and
homeowners. They did so by designing devices that automatically regulated the flow of water into and out of the hopper, thus preventing waste, but which also minimized user intervention, thus decreasing the damage that careless users might do. They accomplished both ends by designing closets in which the water shut off automatically after a specified amount of time, and water, had passed. Thus what differentiated one hopper closet from another was the way in which inventors attached additional parts to it in order to regulate water flow. For example, in 1854 New Yorker Frederick Bartholomew patented a valve-based hopper closet designed to eliminate the type of waste denounced by the Boston Water Board. "Careless persons," he noted in his patent application, neglected to turn the water on, making the closet noisome; worse yet, others failed to shut off the water so that in cities like New York "large quantities of water is [sic] discharged through water closets directly into the sewers, and thus wasted unnoticed and almost undiscoverable by the persons having charge of the water works department . . . ." Bartholomew solved this problem by creating a self-acting closet that combined a hopper, a valve, and a small water tank or reservoir. When someone sat on the seat, his or her weight forced open the intake valve, and water filled a small tank. When the user stood up, the water poured out of this tank and into the hopper, flushing wastes down into the soil pipe. Bartholomew explained that no matter how long the closet was in use--several minutes or an hour--the size of the reservoir limited the amount of water used, and when the user had finished, more water flowed automatically into the hopper. There were no levers, plungers, or valves to be manipulated.
Bartholomew’s design, like other valve-based hoppers, introduced water into the basin only when it was needed for flushing, and all of the water fell into the soil pipe where, hopefully, some remained to fill the trap. James Henry and William Campbell of Philadelphia based their 1857 hopper patent on a different principle (fig. 5.10). The Henry-Campbell design used a bowl-shaped hopper whose slightly flattened bottom held a small quantity of water. Wastes fell directly into water in the bowl, which, when filled with water, doubled as a trap, rather than into the soil pipe. To operate the closet, the user pulled up on a handle, thereby opening a passageway through which the bowl’s wastes and
water flowed into the soil pipe. Pushing down on the handle closed the passage. At the same time, fresh water stored in an attached tank poured into the bowl and valve chamber, preparing them for the next user. A float valve regulated the amount of water held in the tank. This design required more user intervention than the Bartholomew patent, and its proper functioning depended on the the float inside the tank: if it failed, too much water would be released, flooding the bowl. However, the most significant feature of this patent was the fact that wastes fell into a basin of water, rather than into a soil pipe; the water not only flushed the wastes, but it also served as a trap, making this closet less odorous than others. In this respect, the Henry-Campbell patent anticipated the so-called sanitary closets that began to appear in the 1870s. In any case hopper closets like these provided a broad range of Americans with the opportunity to use a modern and improved device. By automating the process of flushing as much as possible, inventors enabled reform-minded Americans to introduce these devices into their homes even when untrained children or careless servants might be using them.41

The Pan Closet

The pan closet, on the other hand, posed a different problem. As the above examples show, the hopper could be and sometimes was more than just an extension of a soil pipe, but even with valves and plungers attached to it, the hopper remained little more than a one piece waste receptacle. In contrast, however, the pan closet was a multi-component object laden with working parts, making it more prone to mechanical failure and easier for careless people to damage. Pan closets probably found their greatest use in private homes, rather than public places,
and especially in homes where servants had their own (hopper) water closet. The typical pan w. c. consisted of at least three pieces. The topmost part was a bowl, often but not always earthenware, with a hole in its base. The bowl’s base nested in the second piece, a copper hinged pan that covered the hole. Both of these sat atop the third part, variously called the trunk, hopper, or receiver (here referred to as the receiver in order to distinguish it from the hopper style closet), which was usually made of iron. As on the hopper, a valve regulated the flow of water into and out of the bowl, pan, and receiver, but in the case of the pan, the valve operated in conjunction with a collection of levers, handles, and cams used to manipulate the pan. Designers synchronized the closet’s parts so that flushing water would push wastes out of the pan, but continue to stream into the pan after it had been tipped back up into place; the pan and its water served both as a receptacle for the wastes and as a barrier against the odors and gases that collected in the receiver and soil pipe. The addition of these parts differentiated the pan from the much simpler hopper, and the arrangement of the valves and pan mechanism distinguished one pan closet from another.

For example, in 1847 James Ingram and James Steuart patented a water closet with two pans but a single handle with which to tip them. Ingram and Steuart jointed the handle so that when the top pan, into which wastes fell directly, was opened, the bottom one, which covered the entry to the soil pipe, was closed. The user dumped wastes into the soil pipe by opening and closing the two pans in order, and the staggered openings prevented foul odors from entering the room. Compared to other pan closets patented during the period, the Ingram-Steuart
design was simple. Indeed, during the 1850s the hallmark of the American pan closet was its complexity, which contributed to its reputation as a high maintenance and rather unsatisfactory device. Inventors attempted to overcome these shortcomings by automating the device's operation and by linking all its parts together so that they would work in one continuous and smooth motion. The patents of William Carr best illustrate this effort.

His 1852 closet used two separate valve systems: one regulated the flow of water from the supply pipe, the other regulated the flow of water into the bowl itself. When someone sat on the closet's seat, the supply valve opened and water poured into a supply tank located above the seat. Removing the pressure from the seat set in motion a series of mechanical events that both flushed the bowl and tipped the catch-pan downward. Carr designed these operations so that the pan returned to its original upright position in time to capture and hold the last bit of water that poured from the tank. In an 1856 patent Carr improved the valve by designing it to close gradually to ensure a good supply of water in the catch-pan. Throughout the 1850s Carr continued to tinker with his water closet designs, but in an 1859 patent application he noted that the process of regulating the water supply in the average water closet still posed problems (Fig. 5.11). Even if the w. c. included a valve that closed gradually, he explained, when the water came "from the supply pipe in one of the lower stories, . . . there is no water rises sufficiently high until after the valve or cock has closed" leaving the pan or bowl dry, odorous, and "unfit for use the next time from this lack of water in the pan." To counteract this, Carr tied the closing of the pan itself to the weight of water in it. Unlike
Fig. 5.11 William Carr's 1859 pan closet
his other designs, this one was operated by hand, rather than by pressure on the seat. The user pulled up on a handle, opening up the closet's supply valve, simultaneously admitting water to the bowl and engaging a cam that tipped the pan downward. Releasing the handle moved the pan back into place, but it also tripped a second cam that held the intake valve open. Thus water continued to flow into the pan until a sufficient weight of water offset the balance of the valve and closed it.45

Other pan closet patents issued at mid-century repeated these basic design elements, constituting variations on a common theme. By and large these devices linked the mechanism for opening and closing the pan to the mechanism that regulated the flow of water, but this complexity had distinct disadvantages.46 Pan closets consisted of complicated and often delicate parts, the failure of any one of which could throw the entire closet out of working order. Tipping the pan dumped the wastes into the hopper below and down into the soil pipe, but unless the pan tipped quickly and sharply downward, wastes spilled onto the sides of the receiver, rather than directly into the pipe. Worse yet, the pan's tipping mechanism and hinge broke easily, and the pan itself tended to corrode; the only way to get inside for repairs was by breaking the puttied seals and unscrewing the plates that held the pieces of the closet together.47 But despite these problems, mid-century inventors continued to design pan closets, concentrating on perfecting a device in which each part worked in synchronism. The problem, of course, was that the more parts there were, the more parts there were to break down and go awry. In that sense, then, the process could never be anything more than a dead end, because it would only lead to more com-
The extent to which Americans used each type of closet is difficult to determine, since city water boards did not always differentiate among types of fixtures. For example, the water boards in Baltimore and Cambridge recorded the number of water closets used in those cities, but not the number of each type. Boston's Cochituate Water Board, on the other hand, recorded both the number and type of closets. In that city pan closets predominated in the early 1850s, but by the end of the decade hopper closets had surpassed them. For example, in 1853 water takers used 1,622 pan closets, 698 hopper closets and 159 "self-acting" closets. By 1857, however, hoppers outnumbered pans 3,215 to 2,765. In 1870 the registrar recorded 11,319 pan closets, but 13,741 hoppers of various types. In his 1878 survey, T. M. Clark described the pan closet as "the variety most extensively used" by Americans, but he added that they proved satisfactory only when made in a superior manner; otherwise their drawbacks made them a household horror. When he wrote that, however, in 1878, other kinds of closets were crowding the American market, and it is doubtful that either the pan or the hopper in their mid-century forms dominated as they had earlier.

As was true of other water fixtures, plumbers' supply houses met the needs of a diverse audience by selling a wide range of closets. A customer could buy a basic hopper, which generally had a short arm formed in the rim for the purposes of attaching it to a water pipe, or a hopper with an attached valve. The William Schoener Company's 1860 catalog offered customers four models of iron hoppers: enameled, plain,
double-, and single-valved. A plain hopper with single valve cost $5.50; with double valve $7.00. A hopper with "Water Waste Preventer" sold for $10.00 plain, and $12.50 enameled. The Jones Company's 1867 catalog offered customers a choice of plain and enameled short and long hoppers, an enameled hopper with an attached "Patent Excelsior Valve," and a hopper "with earthen strainer in bottom" (Fig. 5.12). Some companies sold a basic hopper with an attached earthenware bowl, a combination that, in theory at any rate, combined the hygienic superiority of earthenware with the simplicity and low cost of the iron funnel.

Jones and Company, which sold imported earthenware as well as plumbers' tools and hardware, featured two such bowls in its catalog, while the Schoener Company sold a cast iron stand, complete with valve, designed to hold a closet bowl.

These same catalogs offered a smaller selection of pan closets. The 1859 Naylor catalog included just two types of pan closets, one "plain" and one with a valve. Prices for the former ranged from eight to eleven dollars, depending on whether the pull handle was pearl, plated, enameled, or ivory. The same closet with valve attached started at $10.75. Only the valve distinguished the two devices, so it is possible that the company intended the "plain" closet to be flushed either manually by dumping water into the pan, or by attaching the device to a stop cock or faucet. The Schoener Company sold three types of Carr pan closets: a "self-acting" model, and two other manually operated ones with valves. The self-acting model sold for as little as $9.00. With a basin attached it cost just over two dollars more. The manually-operated devices cost between nine and twelve dollars, depending upon the finish and type of pull.
Plain Water Closet.

Fig. 132.

Enameled Hopper, with Patent Excelsior Valve attached.

Fig. 133.

Fig. 5.12 Water closets from Jones and Co.
Plumbing supply houses also sold valves, basin joints, basins, hoppers, stands, pans, traps, and pipes separately, so that plumbers could design a unique closet for every customer. Indeed, patent applications indicate that installing a water closet was a peculiarly personal experience. For example, valve patents typically directed that the devices could be attached to any "common" water closet. Similarly, patent applications for some other part of the closet, such as the receiver, or for a specific arrangement of valves, pipes, and bowl, usually noted that the user could employ them with any type of valve or devise any kind of water hook-up. Inventors generally patented a part, rather than a complete device, leaving consumers plenty of leeway to design the water closet of their choice, a necessity at a time when personal preference rather than public policy established the form of the technology used in the home.56

This lack of standardization is hardly surprising. As this chapter has shown, in the middle of the nineteenth century, human waste disposal technologies encompassed a wide array of devices; when properly employed or appropriately situated, both the privy and the water closet added to domestic convenience, but each household had to define convenience for itself. Families maximized convenience and improved their domestic environments by arranging water fixtures in a manner best suited to individual sets of circumstances: the family that installed its water closet next to an outside wall needed a device that withstood the elements, while those who installed it in the middle of the house may have found the more delicate pan more to their liking. A rich family could afford the larger expense of the temperamental pan closet, but a family less well off found its convenience in a simpler device that
was less likely to break down. As with showers, bath tubs, and washbasins, manufacturers obliged consumers by providing numerous choices. In any case, all of the technologies outlined here, and in the preceding chapters, indicate that in the middle nineteenth century Americans took seriously the task of progress and reform. On the large scale they tackled slavery and the problem of alcohol, but on the personal level, they examined—and found wanting—the household arrangements and technologies used in everyday life. This examination prompted a three decade effort to define, invent, and implement a host of conveniences that would improve the quality of American domestic life. Beginning in the early 1870s, however, Americans began to re-examine one set of those conveniences, plumbing fixtures. As a result they also began to redesign and rename their household water fixtures so that these devices might better meet the new task assigned to them. The final chapter examines briefly some of the ideas and activities that contributed to the next phase of American plumbing history.
Endnotes


3 By the 1870s the term "sanitary ware" had come into use as a way to describe water fixtures and the so-called "sanitary" flush toilet had appeared in the United States and elsewhere. At that point, American commentators began to write about foreign closets almost exclusively. Indeed, the appearance of the "modern" flush toilets in the late nineteenth century seemed to overshadow completely the mid-century predecessors, relegating them to a status of insignificant fourth cousins, hardly worthy of consideration. Late nineteenth and early twentieth century surveyors of water closet technology all but ignored American patents prior to 1870. Glenn Brown's otherwise exhaustive historical survey of water closets, first published in the early 1880s, only mentioned four of the fifty-three American patents issued before 1870. (See Brown, Water-closets, 45, 72, 88. That number is from the Leggett index, and I counted only devices called "water closet," thereby excluding portable devices, seats, and small accessories to water closets.) Another survey of closets informed the reader that the Henry and Campbell water closets (patented in 1857 and discussed later in this chapter) was "the first United States patent for a water closet," thus ignoring the other ten patents issued either the same year or earlier. See Pottery: A History of the Pottery Industry and Its Evolution as Applied to Sanitation with Unique Specimens and Facsimile Marks from Ancient to Modern Foreign and American Wares (n. p.: Thomas Maddock's Sons Company, 1910), 80-86. The Leggett index listed ten devices called "water-closet" patented between 1835 and 1858. I did not count portable closets or privies.

4 Charles P. Dwyer, The Economic Cottage Builder: or, Cottages for Men of Small Means (Buffalo: Wanzer, McKim and Co, 1856), 51. It should be noted, however, that the U. S. Patent Office issued no less than seventeen patents for improvements to privies between 1820 and 1873.


7Sereno Edwards Todd, Todd's Country Homes and How to Save Money (Hartford, Conn.: Hartford Publishing Co., 1870), 29.

8William Ranlett, The Architect, A Series of Original Designs for Domestic and Ornamental Cottages and Villas, vol. 1 (New York: William H. Graham, 1847), Designs 2-4, 14-18, and p. 32. It is not clear how important privacy or concealment was at this time. In his study of the American home, Clifford Clark noted that servants often had their own porch, so it is possible that one of a set of closets may have been intended for the exclusive use of servants. See Clifford E. Clark, Jr., The American Family Home, 1800-1960 (Chapel Hill, N. C.: University of North Carolina Press, 1986), 43. However, according to Daniel Boorstin, "old-fashioned privies . . . were often designed so that their users could enjoy the company and conversation of fellow-users. The early American outhouses . . . commonly had more than one seat, to facilitate use by more than one person at a time." See Boorstin, The Americans: The Democratic Experience (New York: Random House, 1973), 354.


15Sloan, Model Architect, 1: Design 10, plate 40, pp. 49-50, 52. A similar arrangement is described in John Riddell, Architectural
Designs for Model Country Residences (Philadelphia: John Riddell; Lindsay, Blakiston, 1861), specifications for Design 11.


17 Orson Fowler, A Home for All; or, The Gravel Wall and Octagon Mode of Building, rev. and enl. (New York: Fowler and Wells, 1856), 111.


20 Lewis Allen, Rural Architecture: Being A Complete Description of Farmhouses, Cottages, and Outbuildings (New York: C. M. Saxton, 1852), 111, 123.


24 Catharine E. Beecher, A Treatise on Domestic Economy, for the Use of Young Ladies at Home, and At School (Boston: Marsh, Capen, Lyon, and Webb, 1841), 294.


Valves attached to water closets for the purpose of regulating water intake and output should not be confused with the flap valves found on so-called "valve" water closets. This type of closet did not become common in the United States until the late 1870s and 1880s. A "valve closet" had a flap or other hinged opening (the valve) in the base of the bowl. The user flushed the closet by pulling on a lever or handle that opened flap and released the wastes and water trapped in the bowl. The best descriptions of these are in Brown, Water-Closets, 29-60, and Clark, "Water Closets, I," 74; "Sanitary Plumbing.-V: The Valve and Plunger Closets," AABN 14 (1883): 172-74.

Valves intended for manipulating water flow generally had multiple chambers; manipulating a handle or lever opened and closed the chambers in order to release water into the bowl or soil pipe. Some valves merely released water, while others closed gradually in order to minimize the impact of water hammer or to allow the bowl or pan to refill. Designers usually fabricated the valves of brass and used wire springs, air chambers, and leather, rubber, or other "elastic" packing.

For example, see the patented valve mechanisms in William L. Schoener and Co., Illustrated Catalogue and Price List of Plumbers' Brass Work (New York: Sackett and Cobb, 1860), 65 and 67; J. and H. Jones and Co., Brass Cock Manufacturers, and Importers of Plumbers'

The better descriptions of the hopper were written in the late 1870s, but it likely represents a fairly accurate picture of the device as used during the mid-century years. See Clark, "Water Closets, I," 73-74. See also Gerhard, "House Drainage and Sanitary Plumbing," 324-28; Bayles, House Drainage and Water Service, 94-95.

At mid-century a hopper made of the entirely of earthenware probably would have been both expensive and uncommon, since, according to Pottery (pp. 20-25), American manufacturers did not begin manufacturing earthenware hoppers until the 1870s. Before that date, earthenware hoppers were probably imported from England, and it seems unlikely that the reputed low cost of the hopper would have been based on a costly imported object.

The flushing rim was a relatively late addition to the water closet. In the middle years of the century designers sometimes included a "fan" or "spreader" at the mouth of the supply pipe that forced the water into a spray formation, and at least one inventor designed a bowl that channeled water down the entire surface of the bowl. However, those were unusual, and a flushing rim did not become standard equipment on a closet bowl until later. For patents with spreaders see U. S. Patent 14,902, E. Bookhout and C. H. Hewlett, "Water-closet," 20 May 1856; and Patent 55,967, D. Wellington, "Improvement in Water-closets," 26 June 1866. For inventions designed to push water all around a bowl see U. S. Patent 10,620, D. Ryan and J. Flanagan, "Water-closet," 7 March 1854; and Patent 102,738, D. Wellington, "Improvement in Water-closet Bowls," 3 May 1870. A flushing rim was patented in 1859; see Patent 26,243, W. Boch, Sr., "Water-closet Basin," 29 November 1859.

38Ibid., 7.


40For another description of this patent see "Bartholomew's Improvement in Water Closets," *Scientific American* 9 (1853-54): 240. Two other patents that operated in similar fashion are Patent 18,550, Francis McGhan, "Water-closet," 3 November 1857; Patent 97,639, John B. Hobson and John Middleton, Jr., "Improvement in Water-closets," 7 December 1869.


47Brief, but useful, discussions of these problems can be found in U. S. Patent 76,398, W. S. Carr, "Improvement in Water-closets," 7 April 1868; Patent 76,403, H. H. Craigie, Improvement in Water-closets," 7 April 1868; Patent 79,728, W. S. Carr, "Improvement in Water-closets," 7 July 1868; Patent 80,708, W. S. Carr, "Improvement in Water-closets," 4 August 1868.

48In the mid- to late-1860s, American inventors began moving away from this dead end and down a different path which ultimately culminated in the "flush" toilet. The history of this trend is properly the subject of another and different study, but here it should be noted that American inventors gradually turned away from the complicated
devices, most clearly embodied in the pan closet, and toward closets in which the shape of the bowl, rather than valves and levers, was the key component. It was from those efforts that the "washout," "washdown," and "syphon" closets eventually emerged. The late century porcelain closets should be seen not as the products of a unique phase of development, but as variations on themes well-developed by the middle part of the century. Indeed, the late nineteenth century water closet represents the tail end of a long period of tinkering which culminated in the smooth porcelain toilet still in use today.


Clark, "Water Closets, II," 90.

Clark's 1878 discussion of closets is especially useful because he wrote at a time when American water closets were going through a period of intense transformation, and types of closets long used in England and Europe were finally coming to the United States. Compare Clark to Brown, writing just a few years later: Brown's catalog of closets and closet mechanisms indicates that the field of water closet technology had changed dramatically in less than a decade. See Clark, "Water Closets, I," 73-75 and Clark, "Water Closets, II," 90-92; Brown, *Water-closets*, 28-156.


Clark, "Water Closets, I," 73.


For comments on this flexibility see U. S. Patent 33,070, W. S. Carr, "Water-closet." 20 August 1861; Patent 33,632, F. H.
CHAPTER 6

EPILOGUE

Beginning in the very late 1860s and early 1870s, Americans' attitudes toward and their use of plumbing underwent an intense transformation. By the mid-1890s almost every American city, regardless of size, used detailed plumbing codes and licensing regulations to monitor the installation and use of plumbing, and plumbing fixtures themselves had a new name: "sanitary ware." The era of convenience had ended; the age of sanitation and regulation had begun.

At first glance the sources of change seem obvious. In the 1870s and 1880s hundreds of American municipalities constructed centralized water works that brought pressurized water into increasingly large numbers of homes.\(^1\) The availability of "city" water facilitated the use of plumbing fixtures, especially water closets, but the increasingly large numbers of fixtures in use generated household wastes that overwhelmed available drainage conduits, creating an apparently new health hazard in the form of sewer gas. Public health officials, municipal leaders, plumbers, and concerned citizens lobbied for relief in the form of better sewers and safer plumbing installations.\(^2\) Municipalities responded with citywide unified water-carriage sewer systems as well as plumbing codes that established minimum standards for installation. At the same time, inventors perfected the "modern" flush toilet and manufacturers began producing low cost porcelain fixtures.
that enabled even more Americans to install water fixtures in their homes.

This scenario includes the salient features of the late-century transformation: concerned citizens, the sewer gas craze, newly organized "professional" plumbers, sanitary engineers, and public health officials, and the appearance of water-carriage sewer systems. Missing from this picture, however, are the late-century ideas and attitudes that linked these outward manifestations of change. During the mid-century decades a particular view of the family and the nation combined to shape the use of household conveniences, but in the late century decades, a different set of values emerged; as a result, Americans reassessed their domestic environments and the technologies used in them. It may be useful to end this study of mid-century plumbing by looking, albeit briefly, at an especially potent manifestation and catalyst of new attitudes toward the domestic environment and household plumbing, namely the views articulated by members of the newly-organized American Public Health Association in the first half of the 1870s.

"Sanitarians," as they will be called here, a group that included physicians, engineers, college and university professors, and others, asserted the existence of a body of knowledge, called sanitary science, as well as the expertise to apply that knowledge. By 1872 they had already created a national professional organization, the American Public Health Association, which they used as a forum for espousing a particular view of public health and the relationship between individuals and communities. During the 1870s in particular, the sanitarians' work and the view they articulated played a leading role in shaping a new attitude toward household plumbing.
Put simply, sanitarians claimed the existence of a body of irrefutable facts that, taken together, constituted the laws and principles of sanitary science. They coopted the scientific and medical research that demonstrated the important roles that both air and water played in disease causation and transmission, and "devised a new category of diseases—'zymotic disease,'... to denote illnesses caused by impure air and water." These facts about air, water, and disease constituted the body of knowledge that formed the heart of sanitary science. Sanitary science, explained one observer, "gathers into one the teachings of all other sciences, so far as they bear upon private and public health," with the goal of "mak[ing] these teachings practically operative in the promotion of human welfare..." "Sanitary science," Joseph Toner remarked in his 1875 presidential address to the APHA, "constitutes one of the most important advances and reforms of this or of any age." "Our mission," he reminded his colleagues "is to impart and encourage throughout the United States correct views on all that relates to man's physical well-being." Sanitarians claimed to understand the laws of sanitary science, and, more importantly, to have the expertise necessary to manage and manipulate the laws in order to create healthy cities and healthy homes. "We have only to look about us," commented civil engineer and APHA member Egbert Viele, "to see on every hand individuals constructing edifices, and communities constructing cities and towns... in utter violation of those laws and principles upon which depends life itself." The responsibility for curbing this recklessness and eliminating sanitary ignorance rested with the experts.

Sanitarians linked the laws of sanitary science to a particular
view of society: they argued that the laws of science and sanitation operated in all places and at all times, regardless of locale, climate, or income, and consequently, science, universal and timeless, superseded individual rights. Public authorities ought to acknowledge the sanctity of sanitary science by outlawing practices that violated its principles, even at the risk of invading private spaces and negating individual rights. Sanitarians also linked the universality of science to the idea that society constituted an interconnected whole; the actions of an individual affected others, and no one had the right to engage in unsafe behavior because that behavior affected the whole community. This conception of society had important implications for the idea of public health. During the 1870s and after, American sanitary experts argued that public health laws and reforms ought to encompass everyone, not just the poor in tenements, and that all of the people, rich or poor, immigrant or native, city dweller or suburbanite, contributed to and detracted from the public health. Everyone, explained one APHA member, is "forced sooner or later to bear witness, willingly or unwillingly, to the fact that he is not a unit in the scheme of creation, but is so connected with the other members of his race that what is detrimental to them will be detrimental to him, . . . ." When individuals neglected to honor and adhere to the laws of sanitation, their sanitary shortcomings brought affliction not only upon themselves but, because humans lived in society, upon others as well.
Because the laws and facts of sanitary science were operative everywhere, the work and interests of sanitarians encompassed a wide range of human activities and events. At their meetings, members of the APHA discussed everything from municipal waste removal to epidemic diseases, from the "sanitary requirements" of factories to quarantines and the impact of heredity on disease and longevity.

"Domestic sanitarians," as one historian has called them, formed a particularly active branch of the late century sanitary and public health effort. Domestic sanitarians regarded the home as their special provenance and treated it as "an important vector of disease among all classes of the citizenry." They coopted the group of facts that mid-century Americans had regarded as principles of architecture, such as the importance of correct site selection, good soil, and adequate light and air, and then linked those facts to the principles and laws of sanitary science. By linking the two, sanitarians were able to argue that the "laws" of sanitary science, rather than personal preference or architectural necessity, ought to govern the construction of houses and management of household air, water supply, and waste removal systems. To the notion of science as supreme, the domestic sanitarians added the idea of interconnectedness: no man, woman, or individual home was an island unto itself. Stephen Smith, a New York physician long active in the American public health movement and first president of the APHA, labelled "pernicious" "the legal principle which recognizes the right in general of every citizen to manage his household affairs as he pleases, debarring the right of the State to inquire into and regulate them, so far as they affect the public health . . . ." Each and every family, he explained, by virtue of its intake of material and output of
wastes, "is a perpetual source of unhealthfulness to itself and to the neighborhood . . . ." Smith argued for a "radical reform in the treatment of private and other residences by municipal boards of health, - in other words, to enforce the cardinal principle, 'the house is the unit of sanitary administration.'" His colleague Toner concurred; many people, he observed, entertain "a false conception of personal and domiciliary rights." They assume the right "to do, to neglect, and to maintain-upon their own premises-whatever their cupidity, their ignorance and . . . laziness may elect, without molestation and without question, by neighbors or the municipal authorities . . . ." This view, he added, "has greatly retarded the progress and efficiency of State Medicine."

Domestic sanitarians lamented the fact that so few people understood the scientific principles of domestic architecture and construction, or the fact that every house constituted an unnatural element on the landscape. From "the very moment a spot comes to be builded [sic] upon, it is by necessity placed in abnormal conditions."

The building clears the ground of that herbage which had no unimportant sanitary office [and] covers it from sunlight and sun-heat, and necessarily makes its condition as to moisture quite different. It interferes with the range of winds, and modifies the immediate thermometric and hygrometric conditions of the atmosphere. It throws the rain-fall into streams upon the ground . . . instead of allowing it to diffuse itself in drops . . . . It alters the course of water, making . . . the cellar, the well, the cistern, the cesspool, the privy vault, and the sewer, parts of its underground drainage. In a word, it alters the whole relation of the ground occupied and of its immediate surroundings.

In order to restore the balance between the unnatural man-made structure and the natural environment upon which it intruded, domestic sanitarians argued that homes should be built under "the direction of competent sanitary authority," because only the expert could "fully protect the
household and the community from the dangers to health and life incident to domiciliation," explained one APHA member.\textsuperscript{16}

The construction of dwellings of every description must come under the supervision of that branch of sanitary authority which represents expert knowledge in architecture and engineering. The plans of every proposed dwelling should receive the approval of such authority, in all their essential details relating to drainage, ventilation, heating, and lighting, before the work is done. It is not necessary that every architect should be an expert, . . . only [that he] be required to conform to prescribed rules . . . .\textsuperscript{17}

In domestic architecture, "taste and convenience . . . should be subsidiary to sanitary considerations. The true function of a dwelling is to assist rather than to supersede nature . . . ."\textsuperscript{18} Every aspect of the house, domestic sanitarians asserted, functioned best when installed and built according to sanitary principles.

But domestic sanitarians also regarded the house itself as an interconnected system: the house constituted an organic whole akin to the human body whose parts had to be arranged in a way that ensured the proper functioning of the whole. In this respect, the domestic sanitarians echoed the arguments of the mid-century architects and domestic mavens, but unlike their predecessors, the late century experts touted science, rather than the demands of national progress, as the justification for their assertions. This view of the house as an interconnected system meant that no feature of the dwelling, whether it be the application of wallpaper or the arrangement of the nursery, proved insignificant or escaped scientific scrutiny. Water supply and waste removal, however, received special attention from the sanitarians.\textsuperscript{19} These late century experts argued for scientifically constructed and installed household water supply systems, water fixtures, and waste removal technologies. They explained to their countrymen that
heretofore water closets, bathing tubs, water and waste pipes, and traps had not been installed correctly; that is, plumbers, builders, and homeowners had neither understood nor adhered to the laws of sanitary science, and the resulting improperly installed fixtures caused much household illness. "The introduction of the water-closet marked a real advance in . . . civilization, and . . . 'all the modern conveniences' have made life easier and more luxurious," explained George E. Waring, Jr. in a paper read before the APHA. "But . . . in gaining these marked benefits, we have exposed ourselves to dangers which are all the more grave because of their hidden and almost universally unsuspected character." "So little is known of the sanitary requirements which should govern [plumbing] work, . . . that in securing comforts and convenience, we have, in almost every instance, introduced a real element of danger." 20

Domestic sanitarians found the water closet to be especially troublesome, but because they regarded supply, waste, and fixture arrangements—plumbing—as a whole and interconnected system, they argued that the closet constituted only one part of a larger system. Connected to supply and waste pipes, to other fixtures, and, in some cases, to outside sewers, the water closet's shortcomings—inadequate traps and poorly made pipes—posed a threat to an entire house as noxious gases, especially sewer gas, wafted through other pipes and, eventually, into the structure's many rooms. But sanitarians recognized the larger implications of this domestic problem. In a private dwelling, improperly installed fixtures harmed the occupants, but because each person and each household constituted only one unit of a larger body, improper installation also posed a potential danger to the whole
community. The house's connections to sewers and cesspools provided conduits for potentially poisonous gases: as wastes putrefied inside poorly drained sewers, for example, gases built up and, seeking an outlet, eventually leaked up into the house through bad pipe joints and inadequate traps. The house may have been a "unit of sanitary administration," but it was a unit attached to a larger whole, and sanitarians argued that both the parts and the whole were safe only when organized according to correct scientific sanitary principles.21

The domestic sanitarians' views found fertile ground in late nineteenth century America. A veritable flood of books, pamphlets, and journals explored every conceivable aspect of the scientifically sanitary house in general and plumbing in particular. Professional journals like The Plumber and Sanitary Engineer, American Architect and Building News, and The Sanitarian as well as popular publications such as Atlantic, Harper's, Good Housekeeping, Ladies' Home Journal, and Forum routinely published essays that explored all aspects of scientific and "correct" plumbing.22 Late century architectural plan books often included sections on the importance of proper plumbing installations, but American builders, plumbers, architects, and home owners also benefited from the publication of a number of specialty texts during the 1870s. Several British treatises had their first U. S. printing during that decade, but American domestic sanitarians, sanitary engineers, and plumbers also published numerous texts designed to educate readers on the methods and science of good plumbing practice.23 City and state public health boards and departments, which became firmly established in the United States beginning in the 1870s, as well as medical journals regularly published essays on the subjects of good drainage practice,
correct water closet installation, and the dangers of sewer gas. Manufacturers, sanitarians, and inventors proclaimed the virtues of a number of inventions and improvements designed to overcome the perceived shortcomings of conventional water fixtures. The Rochedale pail system of waste disposal, the earth closet, the Durham system of house drainage, the Liernur pneumatic system of drainage, "odorless excavation" methods of waste removal, and the glass water closet each had its moment in the 1870s and 1880s. By the mid-1880s the idea of the scientifically-arranged house as "a unit of sanitary administration" had become commonplace, and municipal governments responded by formalizing the laws of correct plumbing installation in the form of municipal plumbing codes and licensing regulations for plumbers.

Science was not the only motivating force behind this drive. During the 1880s sanitary science continued to receive attention, but now other factors contributed to the transformation of plumbing's role in the home: Americans dramatically reorganized the structure of municipal administrative machinery in order to ensure greater efficiency in urban systems. Plumbing codes and housing inspectors, along with routinized waste removal, centralized unified sewer systems, and specialized hierarchical bureaucracies enabled city officials to manage increasingly complex urban systems with efficiency and ease. Moreover, "domestic reformers" of a type different than their mid-century counterparts campaigned for more efficient, scientifically managed homes; as a labor-saving device, plumbing helped improve domestic efficiency. Regardless of the impetus for changes in attitudes toward and use of plumbing, however, it is clear that by the turn of the century Americans had dramatically altered their relationship with this
household technology. By 1900 Americans regarded plumbing less as a convenience and a necessity for the few, and more as an integral part of and necessity for a successful public health program, a smoothly functioning urban system, and an efficiently managed domestic environment. True, even then not every American home boasted a full complement of "conveniences," but plumbing had become an increasingly commonplace item in the American home, especially as the price of fixtures continued to drop and as real estate developers built housing developments fully equipped with access to sewer and water lines—and, of course, homes with plumbing. All the modern conveniences had found a permanent place in the American home.
Endnotes


Ibid. Tomes argued that "between 1860 and 1880, changes in both the scientific understanding of disease and the material circumstances of middle-class home life elevated domestic prevention of disease to a new importance." Tomes, p. 517.


Smith, "The Influence of Private Dwellings," 60.


For a good general discussion of the domestic sanitarians' interests see Tomes, "The Private Side of Public Health," 522-28; for a typical scientific discussion of the whole house see Hunt, "Dwellings-Houses in Their Relations to Health," 316-23.


Plumber and Sanitary Engineer in particular provided both professionals and lay people with detailed information about plumbing, but also other features of sanitation and domestic health, such as gas and ventilation. The editors also promoted sanitary legislation, including plumbing codes. For an anecdotal account of the journal's founding see Henry C. Meyer, The Story of The "Sanitary Engineer," Later the "Engineering Record" (New York: privately printed, 1928), 2-10.


26 The best single survey of late century plumbing codes is in Charles V. Chapin, Municipal Sanitation in the United States (Providence, R. I.: Snow and Farnham, 1901), 220-61; but also see Industrial Chicago (Chicago: The Goodspeed Press, 1891), 87-97 and 180-83; Norman, "Scientific Medicine Comes to Philadelphia," 56-57; J. Worth


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D. and L. Bowman Houses, Box 3, Folder 15.
G. T. W. Braman House, Drawer 2, File 7.
Augustus Clarke House, Drawer 2, File 2.
Clay House, Box 3, Folder 12.
Costain House, Drawer 5, File 2.
Court St. House, Drawer 5.
John P. Cushing House, Box 3, Folder 28.
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