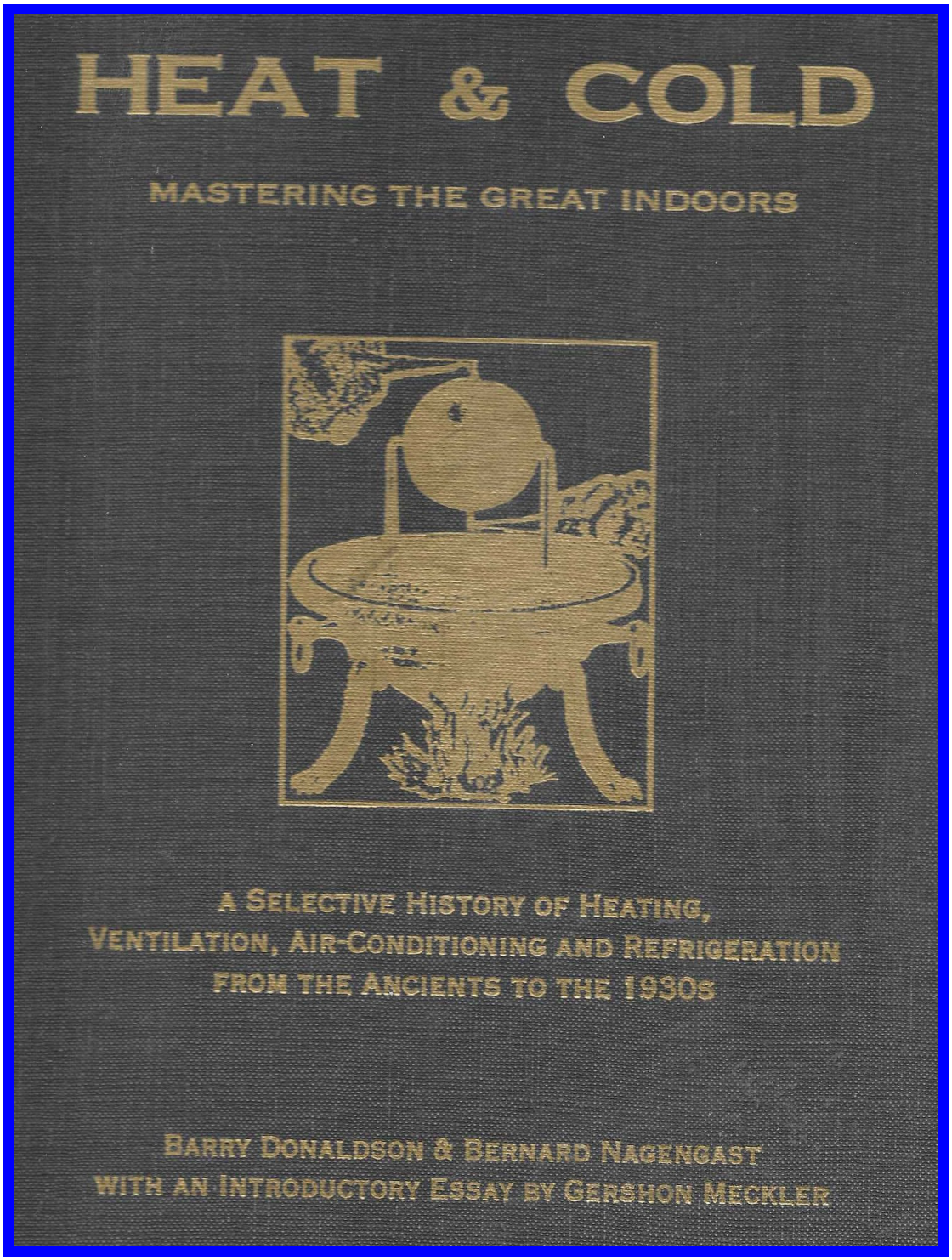
STEAM & HOT WATER BOILERS 1840-1930



FROM AMERICAN HISTORY, ASHRAE 1994

Figure VIII *Nineteenth-century advertising broadside for a "saddleback" steam boiler (from ASHRAE Centennial collection, donated by Ms. Janet Alford)*

Stephen J. Gold and Samuel F. Gold—The H.B. Smith Company

"In the year 1860 the modern steam boiler, either for heating or for power, was still an infant."[33] The development of steam heating for domestic purposes had been limited by problems of explosions and overall safety of operation. The earlier type of shell boiler was a "menace" because of explosions, and the fire tube boilers required constant maintenance and supervision.

Stephen J. Gold, an inventor and iron stove manufacturer from Cornwall, Connecticut, attacked this problem through a series of experiments leading to four patents obtained in 1854 and 1856.

In 1859, Stephen Gold formed the firm of Gold, Foskett & Gold to sell steam boilers and met with the H.B. Smith Company to discuss terms for the lease and manufacture of his steam boiler. This was an upright, wrought-iron shell boiler with a cast-iron internal fire box.[34] Gold developed a radiator to eliminate the extensive wall piping and costly coils that were typical of the work of Joseph Nason. His radiator design, made of riveted sheet iron resembling a mattress, is referred to as the "mattress type" radiator. The radiator was made of two thin plates of sheet iron fastened together by rivets at the bottom of depressions in the outer plate, and the edges were made tight by being rolled up with a piece of cord between them, in such a way as to make them "resistant to the steam pressures." The radiator was equipped with a cock to admit steam and another to let out the air. It was noisy and unsightly and tended to leak.[35] The discussions resulted in an agreement that Gold would

receive a 10 percent royalty on the first $15,000 in sales, which marked the beginning of a successful relationship for many years to come.

The H.B. Smith Co., founded in April 1854 from the original location of Lewis' Stove Works in Westfield, Massachusetts, continued to manufacture all the work of Stephen and Samuel Gold during the rest of the nineteenth century.

The design of hot water and steam boilers attracted the attention of a number of competing firms. In 1857, William C. Baker (who had previously worked with Stephen Gold) and John Jewell Smith formed a partnership as Baker, Smith & Co. in New York and were the first to introduce a water-tube boiler with a box coil for indirect steam heating.[36] Stephen Wilcox of Westerly, Rhode Island, patented a "little pipe boiler" in 1856, which was later manufactured and "perfected" in the first boiler manufactured by the firm when it was organized in Providence in 1867.[37] The water-tube boiler was very successful for the next decade, and its applications for high-pressure steam became especially attractive later in the century for large-scale electrical generation.

Samuel Fay Gold (1840-1907), son of Stephen, who had worked with his father in Cornwall since childhood, received a patent in 1859 for a low-pressure, cast-iron, vertical-section boiler and again turned to the H.B. Smith Company of Westfield, Massachusetts, to manufacture and sell his "Gold boiler" (Figure 7-25). Gold had adapted his original boiler designs from previous work by George B. Brayton of Providence, Rhode Island. Brayton's work involved experiments with a sectional cast-iron boiler in Westerly, Rhode Island, where in 1849, "in the winter of that year," according to his own account, he mounted such a boiler on a locomotive which made a few trips on the ice. Between that date and 1864, he secured several patents, one

of which included the means of heating a building.[38] In 1865, four years prior to the second Gold boiler patent, the Brayton "Exeter" boiler (named after the Exeter Machine Works of Boston and Exeter, New Hampshire) received the highest honor of the Massachusetts Mechanics Association and was exhibited at the Centennial in Philadelphia in 1876[39] (Figure 7-26).

However, the Gold sectional, fire-tube-type boiler for heating buildings was "superb and, with constant improvements, held its own for half a century."[40] Samuel Gold also adopted the concept, initially conceived by Thomas T. Tasker of Philadelphia, of returning the water of condensation to the boiler, and in 1862 he, with William Foskett, patented the "Gold Pin" radiator that offered an indirect means of heating.

The Gold boiler introduced low-pressure steam heating with indirect cast-iron radiators that "not only caught the public fancy, but practically changed the entire heating methods of the whole country."[41]

John Henry Mills (1834-1908)

The practical application of steam heating was greatly advanced by the work of John Henry Mills, a "mechanical genius, who was in turn craftsman, inventor, heating contractor, scientific investigator, and engineering consultant." He became one of the most widely renowned engineers in

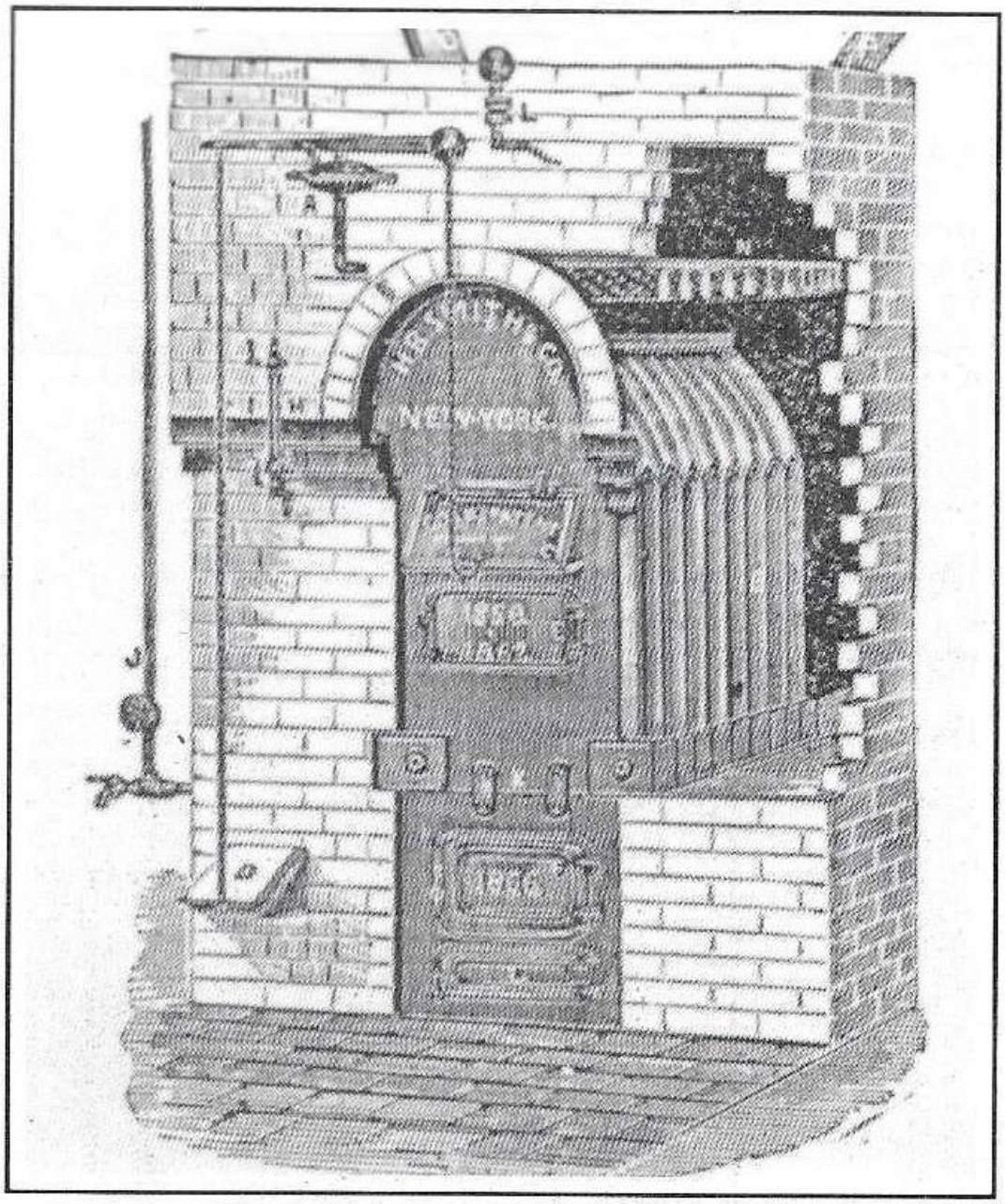


Figure 7-25 *Original Gold boiler, 1859. "The original Gold boiler—first boiler to be manufactured by H.B. Smith & Co.—in its first form consisted of an assembly of vertical cast iron sections held together with draw bolts and gasketed at the joints. These boilers were invariably installed in brick chambers and fed steam to indirect pin type radiators in the same chambers thereby warming air that was duct conducted to the rooms. Steam also could be fed directly to crude radiators or pipe coils in more distant rooms" (Stifler, 1960. H.B. Smith Co.).*

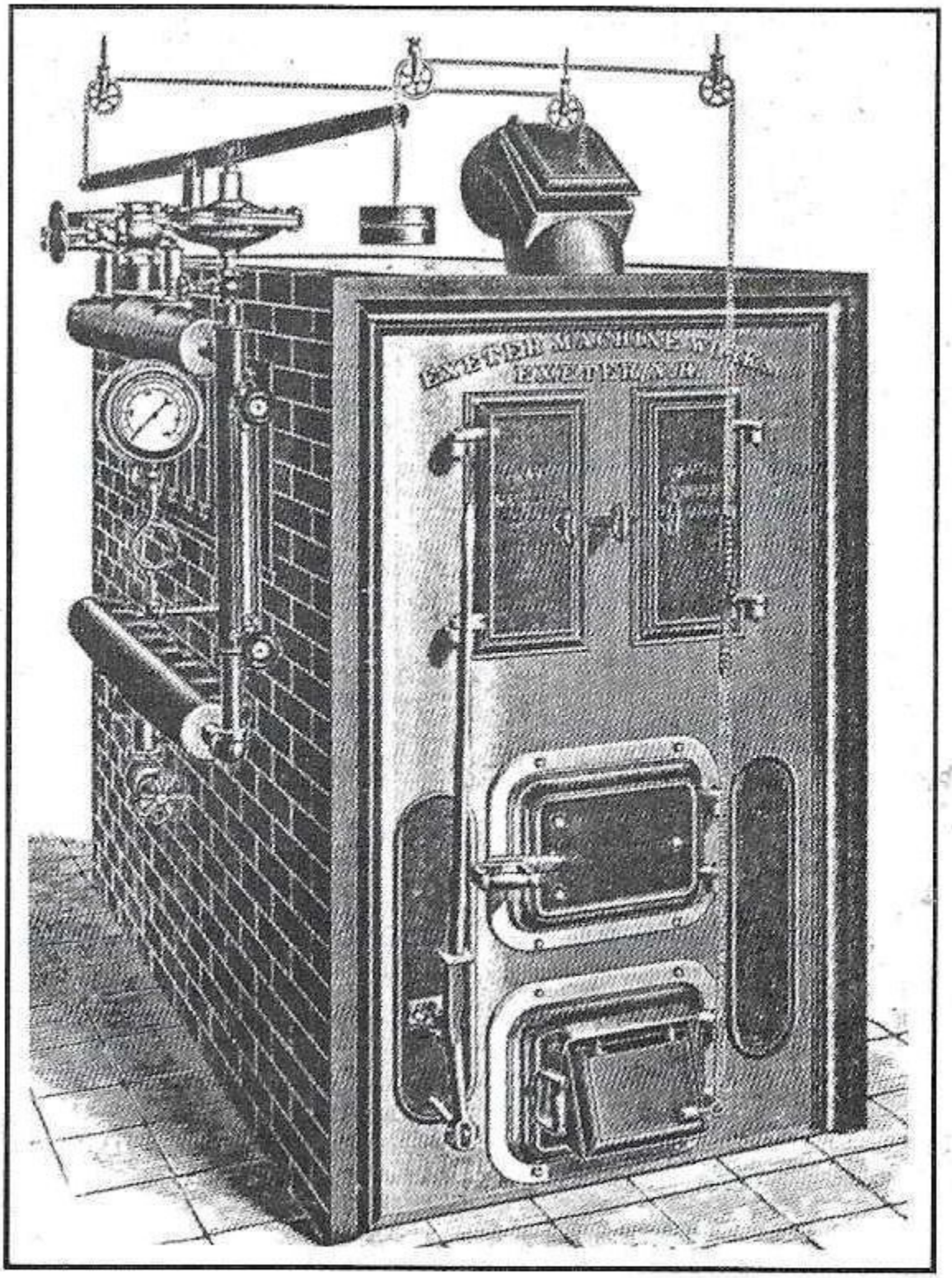


Figure 7-26 *The Exeter steam boiler (from* Heating and Ventilation, *April 15, 1894).*

the United States during the last quarter of the nineteenth century.[42]

> Following Brayton's lead, John H. Mills in 1867, patented his first cast-metal sectional boiler. This one was designed for use with an engine but others, for heating, appeared in the years between 1869 and 1874. A Walworth catalog of 1892 makes the statement: "It was at our factory in Cambridgeport, Massachusetts, in 1870 that the first Mills Sectional Boilers were made and a little later his direct and indirect radiators." Mills himself regarded his third boiler as his "first practicable boiler," the manufacture of which, he says, was begun by George W. Walker & Co. at Watertown, Massachusetts, in the foundry of Miles Pratt & Co.
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> The first reference to a Mills Product which appears in the records of the H.B. Smith & Co. is under date of 28 August 1871, when 300 pounds of Mills boiler grates at 7 cents a pound were ordered by the Union Steam and Water Heating Company of New York through the Westfield firm. Eighteen months later (1 March 1873), the Smith Company was in complete control of Mills boiler manufacture.[43]

"In spite of his success with steam, Mills soon turned to water as a superior heating agent. As early as 1877, he had observed its increasing popularity and admitted that it was more silent and steady than steam and more economical of fuel. His extensive work with water began in the mid-eighties."[44] Mills worked on water-heating systems for a number of notable projects, such as the Pierce Building (1887) in Boston and substituting a hot water system for the existing air system in Trinity Church (1888), also in Boston.

In 1877, John Mills wrote a small treatise on *Heating by Steam*, and between 1888 and 1890, he wrote his two-volume book *Heat, Science and Philosophy of its Production and Application to the Warming and Ventilation of Buildings*, which

was published in 1890. "The book is a curious mixture of science, history, and current practice, but is a mine of miscellaneous technical information, with elaborate diagrams and charts."[45] This two-volume opus was an important resource for boiler and steam heating engineers for years to come.

In his later years, John Mills achieved enormous success in his industry. "Money came so easily before 1897 that, as he grew older, with no one dependent on him, Mills was inclined to indulge in ultra extravagant experiments."

> There is a story, still current at the Westfield foundry, that at some time in 1905 or 1906, John Mills drifted into town shabbily dressed and practically penniless. J.R. Reed, shaking his head sadly but with a characteristic twinkle in his eye, remarked: "John Mills, I always warned you of this. Didn't I say that if you kept on at the rate you were going you would surely scratch a poor man's pants?" Then, putting a check in the old man's hand, he added, "You are not going to give this money away or use it for any more experimenting. It is to take care of John H. Mills." This was the last time that Mills was seen in Westfield. The check was for $5,000.[46]

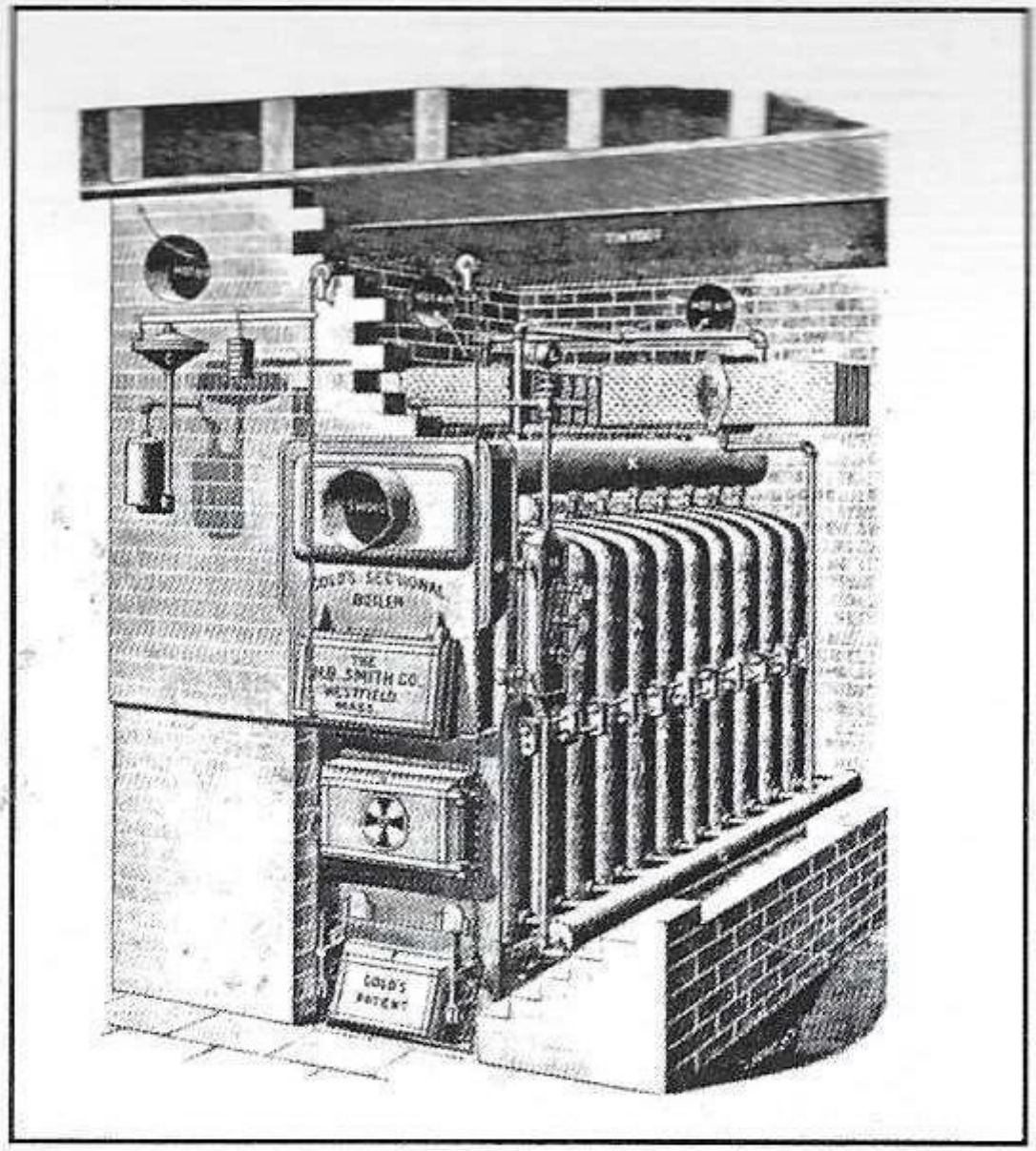
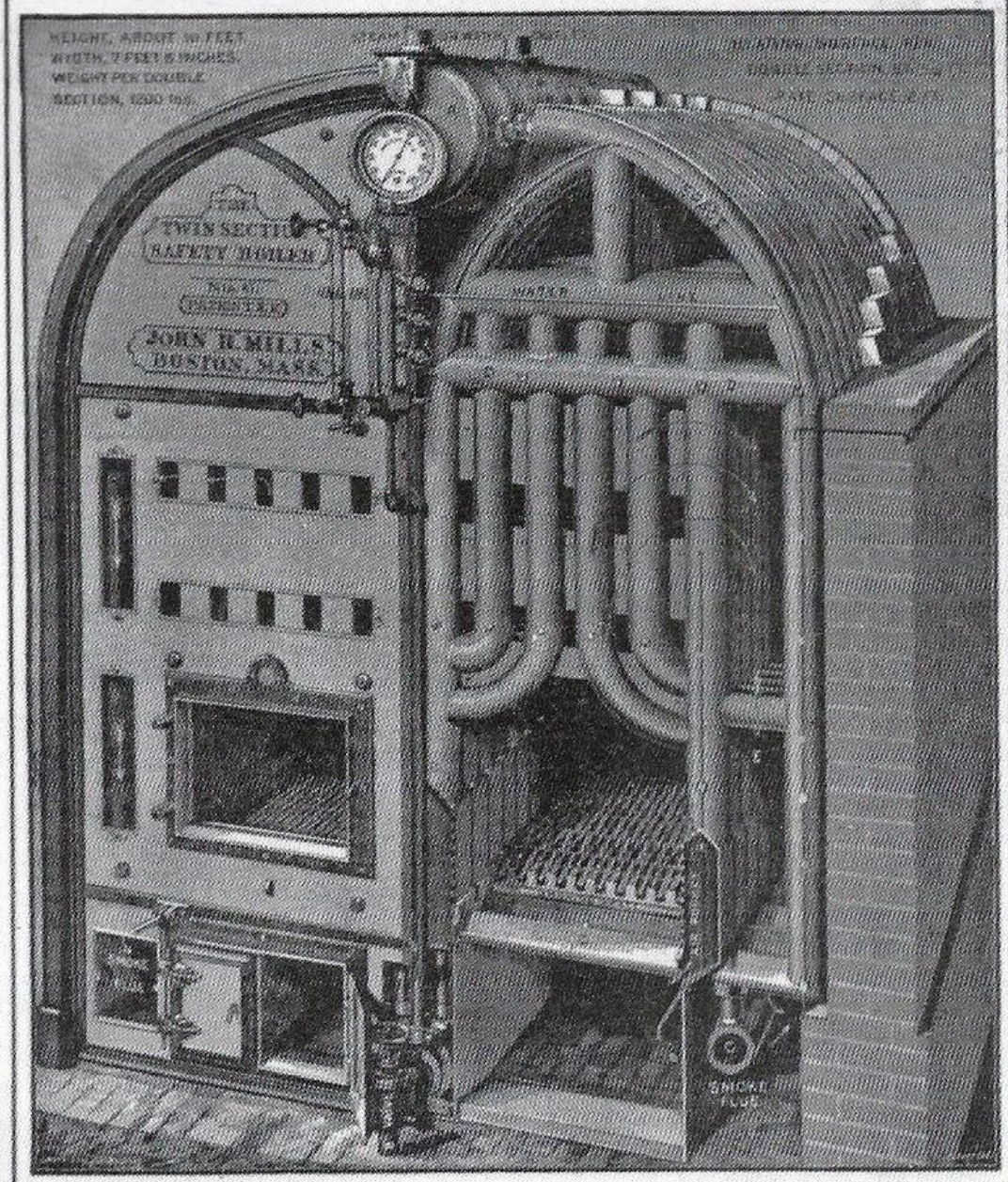


Figure 7-27 *Gold boiler, 1880s. "By the eighties, the Gold boiler had become considerably more sophisticated. Exterior drums with nipple connections to the sections had replaced the old direct connection method although draw bolts were still used. The fire travel remained two pass through horizontal fire tubes formed by the sections themselves, with the smoke outlet discharging at the front of the boiler (Stifler, 1960. H.B. Smith Co.).*

PLATE No. 14.

MILLS STEAM AND WATER SAFETY BOILER, No. 6.



Regular steam and water circulating boiler of 50 to 100 horse-power. Three of these are in use at the Pierce Building, Boston, Mass., three at the county buildings, Springfield, Mass., and three at State Prison, Cranston, R. I. (See evaporative experiment, page 265.)

Figure 7-28 *Mills steam and water safety boiler, no. 6 (from J.H. Mills, 1890).*