A History of the Development of the Radiator

By ARA MARCUS DANIELS

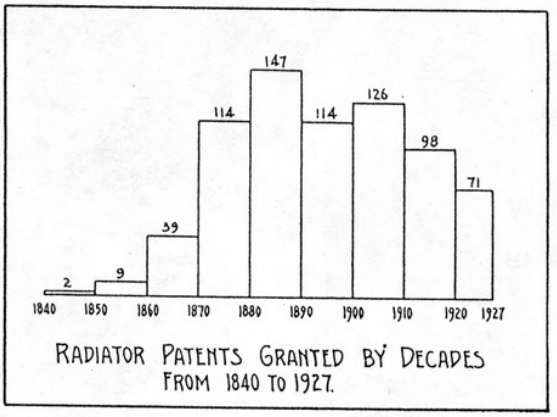


Fig. 1.—During the last eighty-seven years, no less than seven hundred and fifty patents applying to hot water and steam radiators have been granted

THE BIRTH of a useful idea, its gradual development into tangible form, the changes, modifications, alterations and elaborations accompanying its blossoming out into recognized popular usefulness and its ever present opportunity for still further advances in the art which it fostered, presents always an interesting field of research.

So it is with the practice of radiator heating. While the means of heating is at least seventy-five years old, the stages of development of the radiator to the familiar forms of today are appreciated by comparatively few, and the opportunities to improve and enhance are perhaps as great today as at any time throughout its development period.

Who can say when the first so-called "radiator" using hot water or steam, was installed in this country? Where can we look for some comprehensive picturization of the gradual unfolding of the idea that a receptacle for hot water or steam placed in a room would suffice to warm it to a comfortable degree for extremely low outside temperatures?

A search of the records of the United States Patent Bureau relating directly to the steam and hot water radiator as used in the application of steam and hot water heating to all types of structures would show a total of not less than seven hundred and fifty patents granted during the last eighty-seven years or an average of more than eight claims allowed per year. The chart of Fig. 1 illustrates the distribution of patents granted by decades from 1841 to the present.

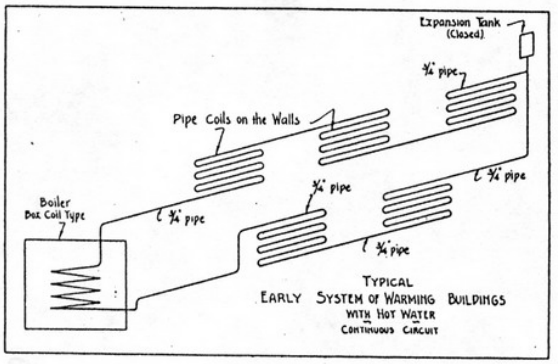


Fig. 2.—When hot water was first used as a heating medium for warming buildings, the system consisted almost exclusively of three-quarter inch piping. The boilers were of the box coil type with all fittings omitted, other than couplings. The expansion tank was seldom provided with an outlet. The coils located on the walls of the rooms represent the earliest type of hot water radiator and served as the only safety valve of these early systems

The radiator has a history. To learn something of that early history, we must knock at the door of the hot water heating system. In 1837, Joseph Nason, who established the Nason Manufacturing Company in 1841, went to England and identified himself with a Mr. Perkins, the inventor of the Perkins' hot water system of heating, which at that time was well known and recognized throughout England. Mr. Nason superintended the erection and installation work in London and elsewhere.

This early system of warming buildings by means of hot water was really a closed system constructed almost exclusively of three-quarter inch piping. The boilers were of the box coil type being made in one continuous length without fittings, other than couplings, with all bends made in the pipes.

The radiating surface consisted of similar coils made without fittings and no valves were provided for regulating the circulation. There was an expansion tank near the top of the system, but it was seldom provided with a safety valve. Thus, the earliest hot-water radiators were coils carried about the sides of rooms (probably first used in greenhouses) in a very primitive manner. The circuit was continuous from the boiler, through the different rooms, and back to the boiler. Hence, the water from one coil passed in turn through each of the others in consecutive order, with the result that the water in

each coil, after the first one served, was cooler than in that directly preceding it. See Fig. 2.

Obviously, it was soon found that pipes of large diameter were required in order that resistance to flow would be low enough to permit water to circulate in sufficient volume, to maintain a temperature in the last radiating surface served that would be high enough to assure heating service from that radiating surface. The bulk and appearance were objectionable features of this system, but the greatest objection was the fact that no part of the circuit could be interrupted without affecting the whole. Consequently, no valves were used and as it was a closed system, the radiating surface was the only element of safety. Hence the problem that faced the designers of these early systems was that of providing radiation having sufficient surface to dissipate heat at a rate equal to or in excess of that imparted to the water in the boiler. Thus, these early types of radiators were the safety valves of the entire heating system.

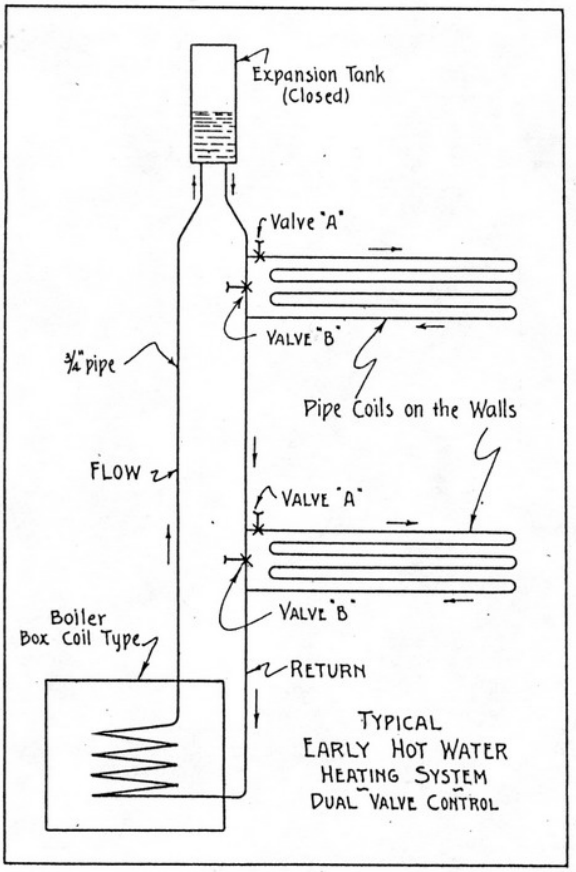


Fig. 3.—To permit separate control of the different coil radiators, two valves were next tried. While this solved the problem of control, the nuisance of handling two valves often resulted in trouble through the opening or closing of the wrong valve or both

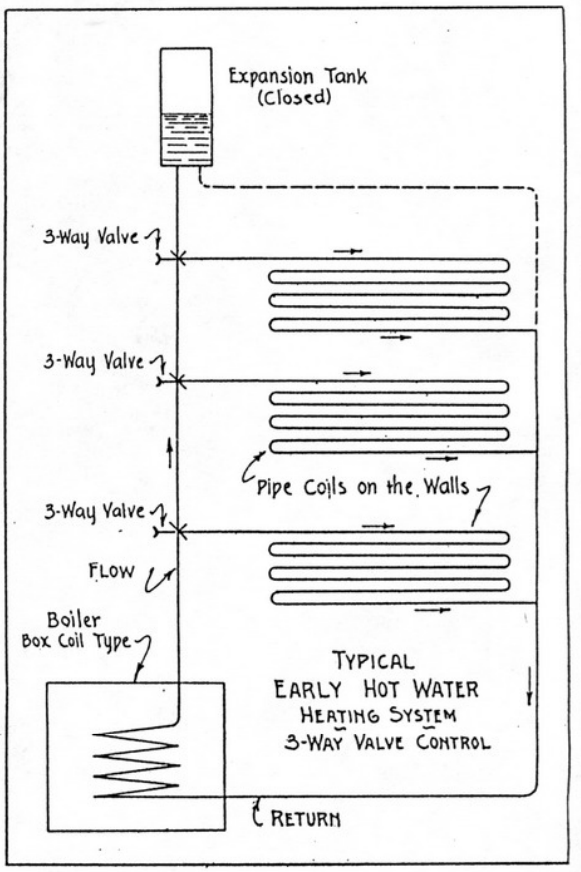


Fig. 4.—Replacement of the two control valves shown in Fig 3 with a single 3-way valve served to eliminate the trouble caused often by the personal equation

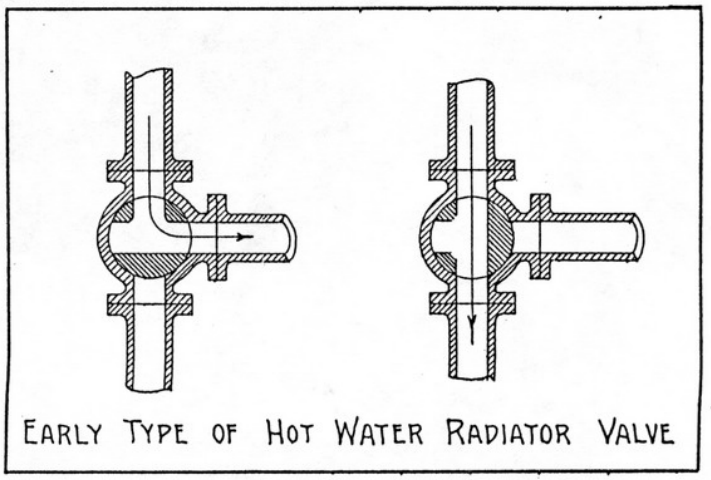


Fig. 5.—Illustrating the interior construction of this early type of hot water radiator control valve

Earliest Application of the Hot Water Radiator Valve

The next development was to provide a system built on the principle shown in Fig. 3. Two valves were provided for each radiating surface, as shown at A and B in Fig. 3, so that by closing A and opening B, the particular surface could be cut out with positive circulation still maintained. We have here what might be consi-

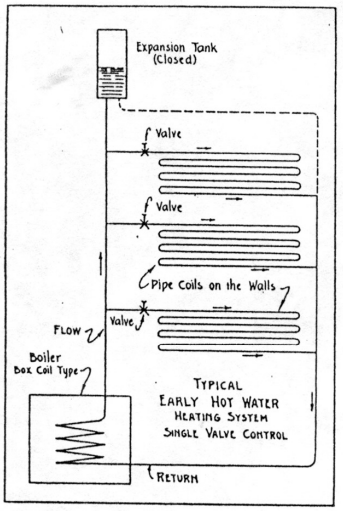


Fig. 6.—Piping the system as shown here served to contradict the idea that a continuous circuit was essential to circulation, permitted the use of a single straight-way valve and proved that part of the flow would pass through the radiating coil and still maintain a circulation through the flow and return mains

ered the earliest application of the hot water radiator valve.

While this arrangement solved the problem of control

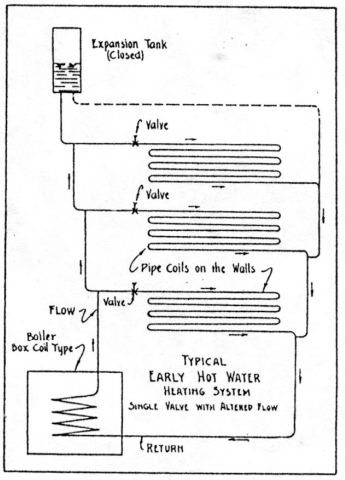


Fig. 7.—To assure more even distribution of flow, resistance due to change of direction of flow was introduced resulting in improved heating service

stalled as shown in Fig. 4. The operation of the valves is illustrated in detail in Fig. 5. The large pipes of the same size throughout the system were still used.

It was decided that a continuous circuit was not essential to circulation. On this theory, the radiating surface was connected to the piping system as shown, typically, in Fig. 6. Here, a single valve was used on each radiating surface. Part of the flow circulated through the heating surface or coil when the valve was partly or wide open, while the main circuit was maintained through the main supply pipe to the tank and thence through the return pipe to the boiler.

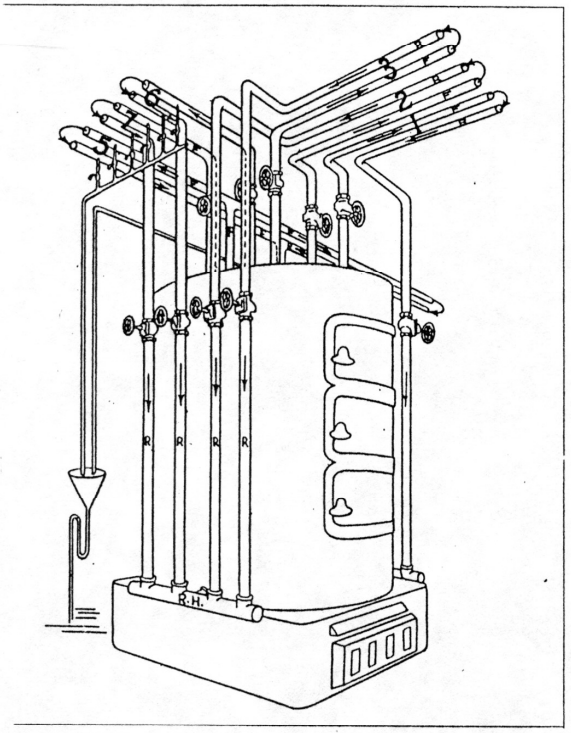


Fig. 8.—Piping for hot water heating systems in these early mes was treated much as plumbers treated circuits for domestic water supply in the best work. Each flow and return ne was valved at the boiler with a small "draw-off" line for emptying the circuit

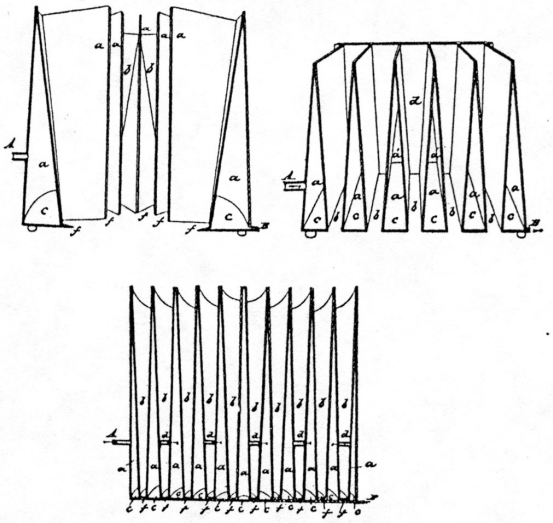
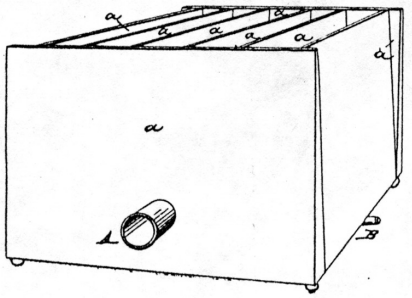


Fig. 9.—The earliest idea for a steam or hot water radiator designated "The Temperative Heat-Distributor." It represents a crude form of the radiator of a later period

t water to respective radiating irfaces, so long as valves A and were closed and opened properly, yet, so often, one valve was pened without closing the other vice versa, that circulation was ıtir stopped with resultant oub.e. So, to correct this condition, one three-way valve was used replace the two valves, and in-



Under these conditions, radiating surfaces at different elevations above the boiler, delivered different quantities of heat for the same surface. The upper coils or surfaces were warmer than the lower coils. The tendency of the hot

Fig. 10.—"The Heat Distributor" of the early 50's in box form

water was, and is, to flow to a highest point. It was passing the lower branches. Distribution was so uneven that various ideas were tried out in practice in the

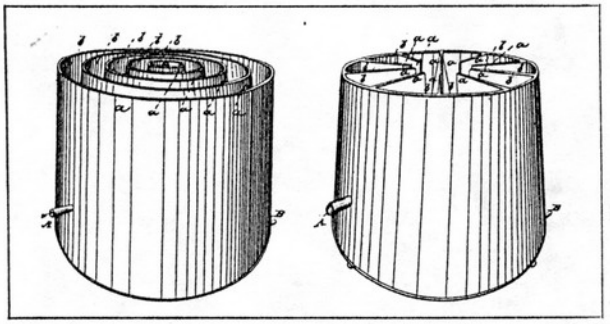


Fig. 11.—The cylindrical form of the "heat-distributor" of the early 50's

effort to produce uniform distribution. It is interesting to note that change in pipe sizes was not considered, the old idea prevailing always that large pipes of the same size should be used throughout the system.

Finally, the plan of introducing resistance by changing the direction of flow was tried. The piping arrangement shown in Fig. 7 was employed. Thus, the current of hot

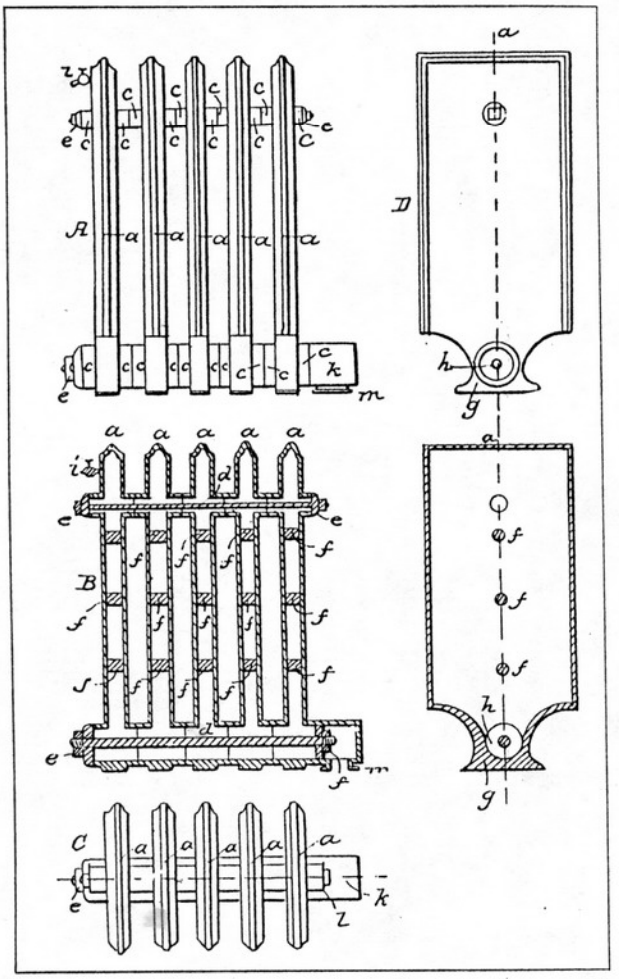


Fig. 12.—About 1860, the steam cast-iron radiator began to take form by which it may be identified with that of today—a crude five-section radiator

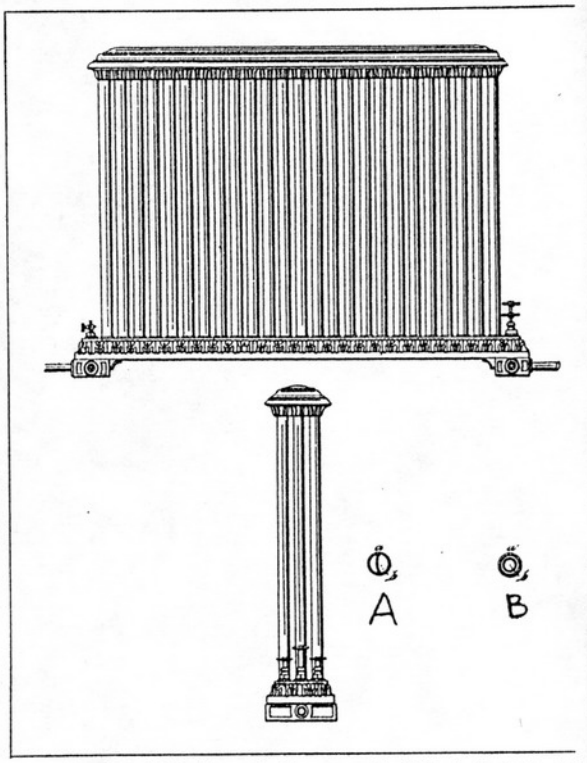


Fig. 13.—In 1862, Joseph Nason and Robert Briggs we granted a patent for improvement of steam radiators whi stimulated immensely the manufacture of this apparatu the general appearance followed closely that accompanyi the illustration for patent

water was divided and diverted so that flow t radiating surfaces was improved and the coils or s..fac emitted h more nearly proportion their radiati surface.

Today, it m seem stran that, at th time, no o thought of c trolling or g erning the fl through pro proportioning pipe sizes, when it is r ized that th were available those days c paratively f

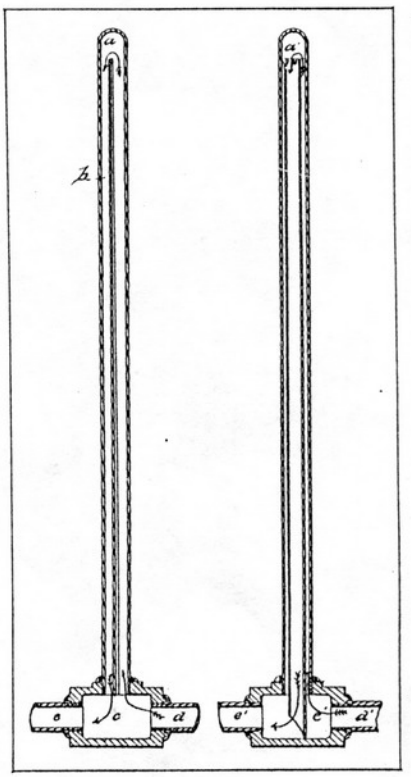
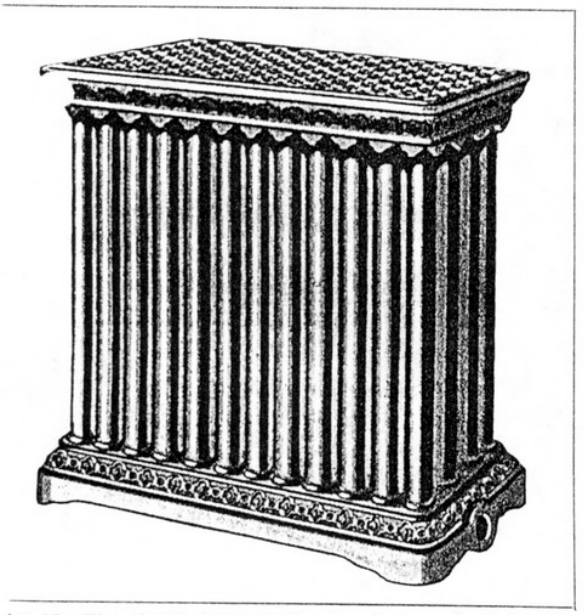


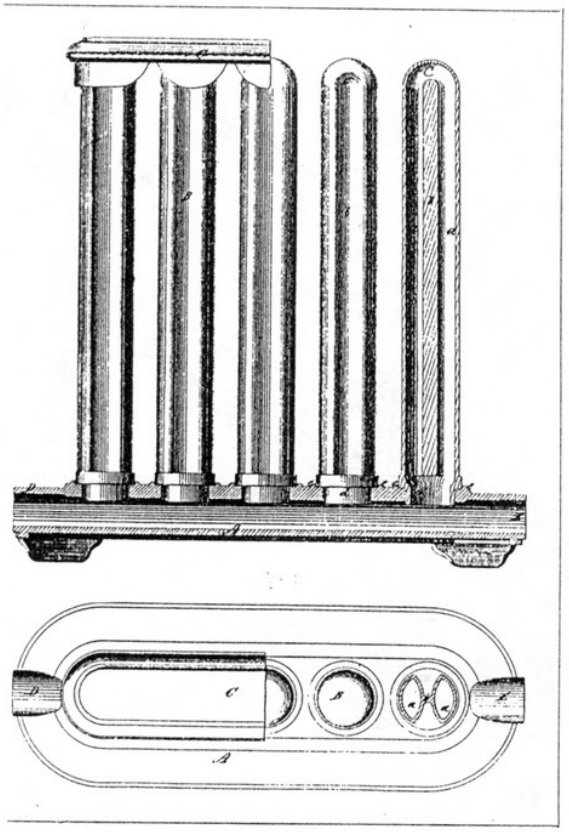
Fig. 14.—The son and Bri patent rela primarily to construction the tul - diaphra... was claimed n essential for m efficient opera

lifferent sizes of pipe, the impracticability of so doing is ppreciated.



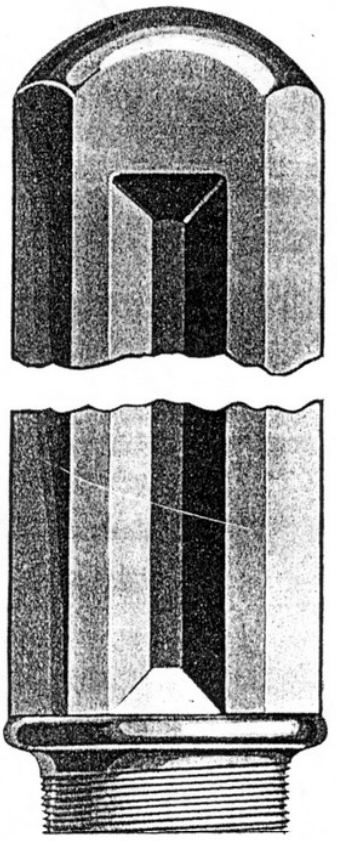
ig. 15.—The Nason "Standard" wrought-iron welded tube diator with 4 rows of tubes built in 8 sizes equipped with one inlet. In use during the 60's and 70's

Thus, we look to the principle of hot water heating r our earliest forms of radiators and we realize that



. 16.—In 1872, Nelson H. Bundy was granted, probably the t patent on the loop tube whereby independent devices as in the Nason patent were eliminated

Fig. 17.—Cross section and outward appearance of the Bundy-Tompkins steam and hot water direct radiator loop



these radiators of the coil type persisted so long because of the prevailing general idea that continuity of the current of water should not be interfered with under any circumstances.

One of the earliest hot water installations employing these coil radiators made in this country was handled by Mr. Nason above mentioned. It was installed to warm the counting room of the Middlesex Mill in Lowell, Mass., about 1841.

For this work, practically all pipe used was imported from England for the job.

It is interesting, in passing, to observe as the art progressed, that

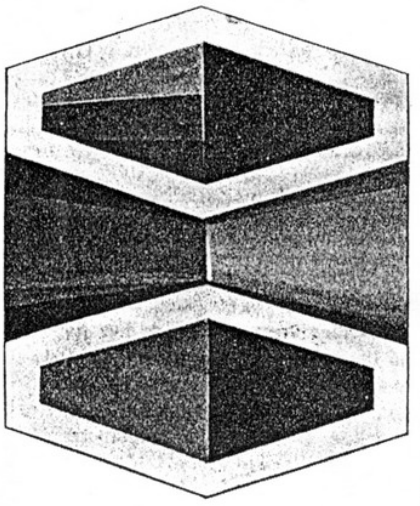


Fig. 18.—Radiator loops as built in three types of radiators used during the 80's and 90's. These loop sections were used in steam and water radiators. The standard section was patterned so that every 12 in. of lineal length represented one sq. ft. of heating surface, full measurement. The steam radiators had one-half sq. ft. of surface per loop in the base and hot water radiators had the same total in both base and upper circulating chamber making one sq. ft. per loop. The enlarged and extended sections contained 20 per cent more surface than the standard section; the extended, however, occupied less floor space than the enlarged

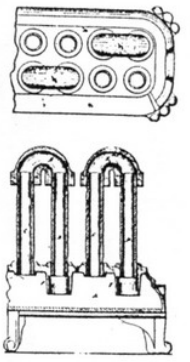


Fig. 19.—To assure steam entering certain tubes before others, projections were placed thereon and more responsive heating of the radiator was claimed—mostly a dream of the patentee

the hot water circuits, in these better and improved systems, were treated in very much the same way as plumbers treated circuits for domestic water supply in their best work. In Fig. 8, it is seen that the flow and

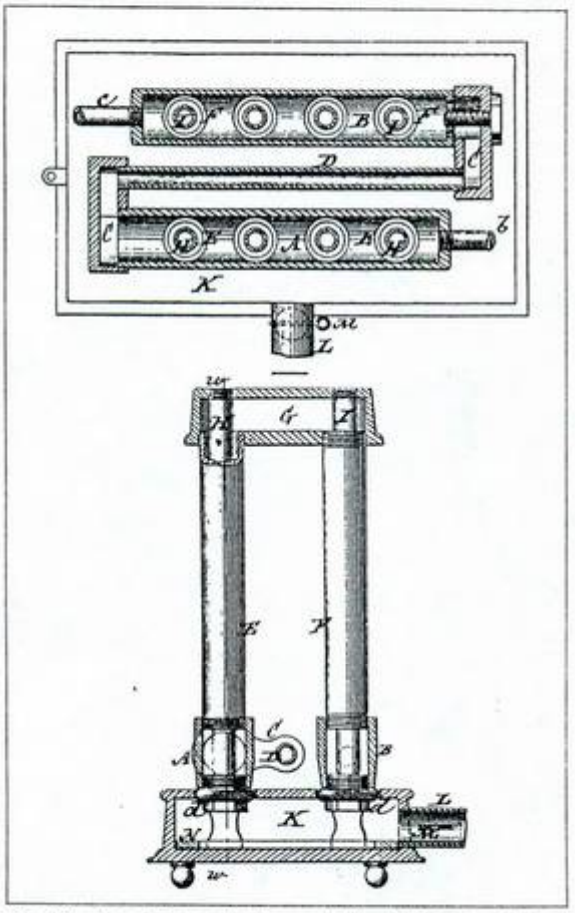


Fig. 20.—One of the early types of direct-indirect radiator—the radiator rested on an "air" base K, and air passed up through the tubes

return pipes were supplied with valves close to the boiler. A line of small draw-off pipes were placed in the flow and return pipes on the house side of the stop valves to allow drawing the water from a line or circuit and emptying into a funnel. The funnel was trapped into the sewer and the overflow-pipe from the expansion tank was also discharged into it.

Steam heating apparatus, in all its details, as used in

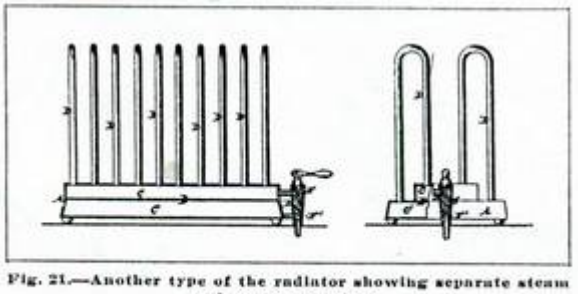


Fig. 21.—Another type of the radiator showing separate steam and water chambers

America, is peculiarly American, and its origin is properly credited, so far as the writer is informed, to Joseph Nason. The radiator probably owes its birth to the use of the tapering thread on the ends of the pipe. The

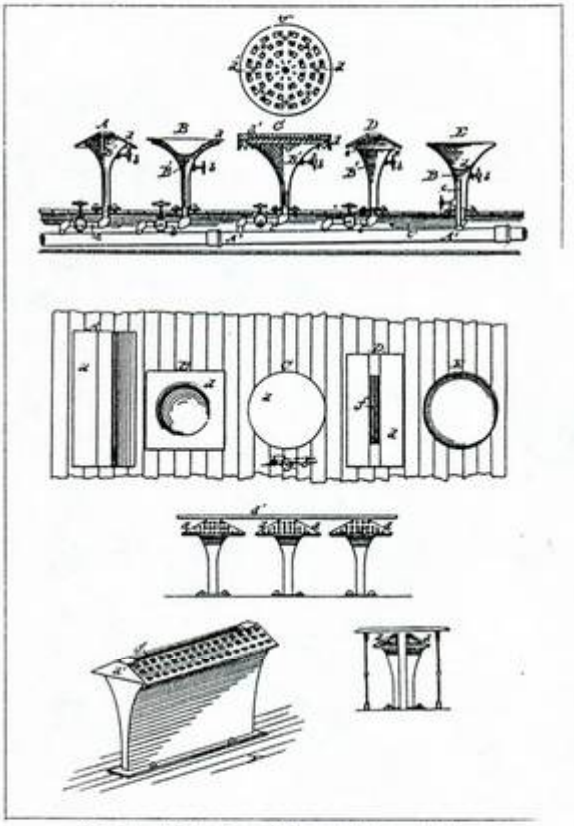


Fig. 22.—Ideas of radiators of the early days

original radiator, possessing characteristics resembli present day radiators, consisted of a row of wrou iron pipes screwed into a cast iron base with the up end of the pipe closed by welding in a metal button the top.

To Mr. Nason credit is given, by some, for the coin of the word "radiator" as it is used today to design

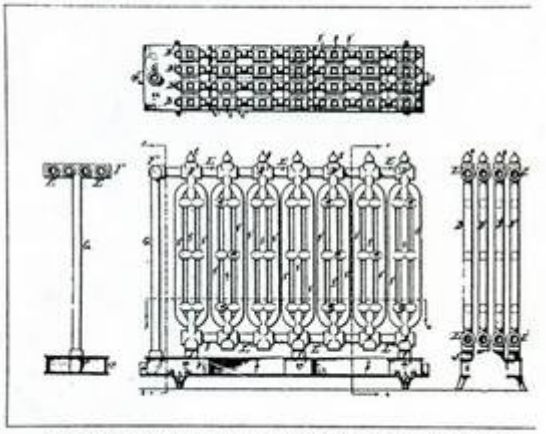


Fig. 23.—Other ideas of radiators of the early days

that part of the hot water or steam heating system by which structures are warmed through standing direct radiation. Unquestionably, Mr. Nason may be consid-

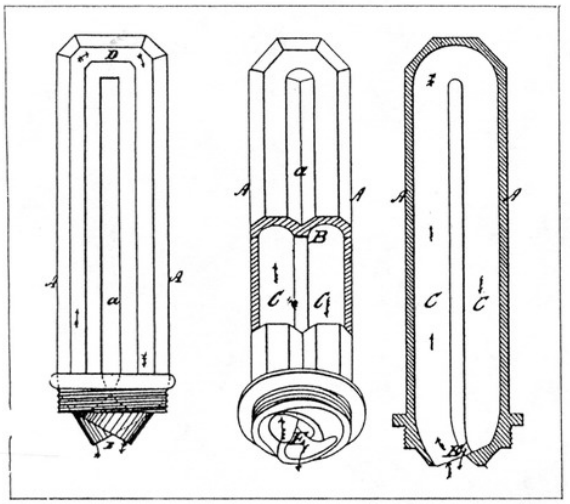


Fig. 24.—The prototype of the two-column radiator—about 1875 to 1880

ered the father, if not the grandfather of our present systems of warming buildings as the art is practiced today. Much of his time was spent, also in the development of fittings, valves, etc., used in such work, for he took out patents for cast-iron fittings, malleable fittings, tapered joints, screwed and flanged valves, the angle

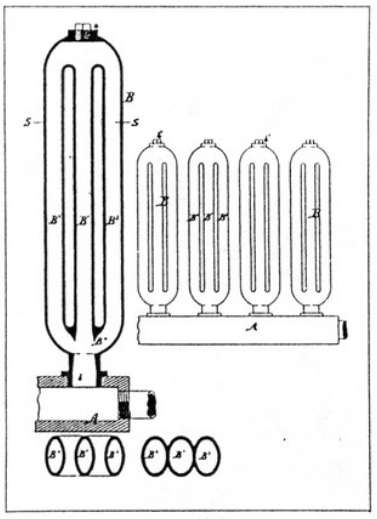


Fig. 25.—The prototype of the three-column radiator—about 1875 to 1880

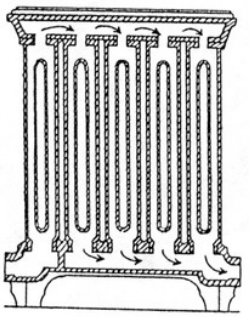
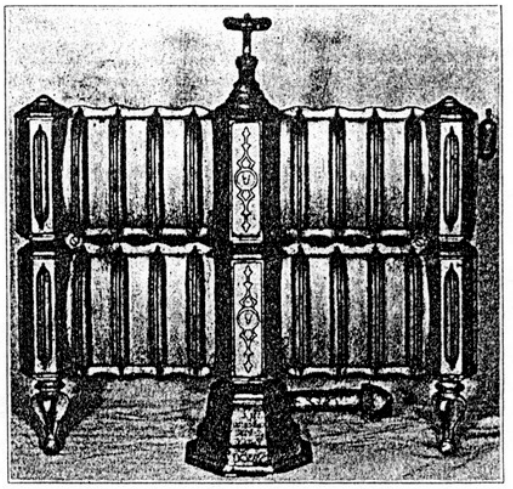


Fig. 26.—The "Bundy-Tompkins" hot water radiator as first constructed. The partition at left was introduced to turn the water into the head and prevent its passing from inlet to outlet. This partition was found later to be unnecessary



Courtesy Richmond Radiator Co.

Fig. 27.—An ornamental type of one of the "old boys." With the radiator valve cast directly into the radiator, it presented a unique appearance. The particular radiator shown was installed in a Chicago building in the late 60's or early 70's

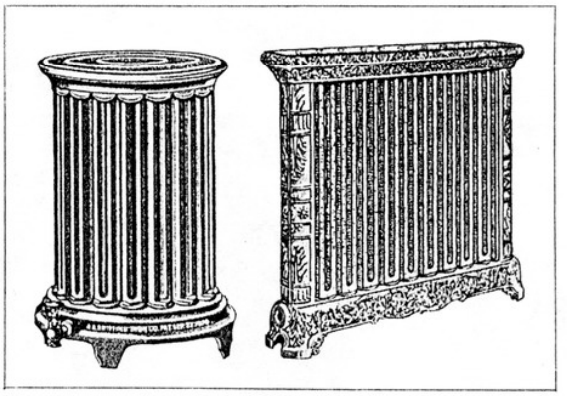


Fig. 28.—Circular radiators, popular types of long ago. The circular radiator was built in 36 and 42 in. heights with base diameters varying from 17¼ to 36 in. with heating surface ranging from 35 sq. ft. to 306 sq. ft. for the high type and 30 to 252 sq. ft. for the low type

Fig. 29.—Renaissance direct radiator, decorated pattern. This single row radiator was built in three heights, 24½, 31 and 37 inches, of the standard width

Fig. 30.—Triumph direct radiator. This radiator was built only as the three-column type with circulation up the central and down the two outside legs. The sections were of parabolic form. It was furnished with top as shown. The sections were connected by 2-in. nipples, cut from extra heavy oil well tubing to give large area as compared with 1½-in. nipples cut from ordinary steam pipe. It was built in a 36-in. height with 5½ sq. ft. of surface per section 8 in. wide