Specification forming part of Letters Patent, No. 145,962, *dated Dec.* 30, 1873.
Application filed April 19, 1873, *and Reissue No.* 6591,
dated August 10, 1875.

SYSTEM OF STEAM AND WATER PIPING FOR BUILDINGS.

To all whom it may concern:

Be it known that I, JOHN H. MILLS, of Boston, in the County of Suffolk and State of Massachusetts, have invented an Improved System of Piping for Buildings to be heated by Steam, of which the following is a specification:

This invention relates to a new and improved method of piping for buildings to be heated with steam, whereby the cost of steam-heat is reduced, and a more simple and efficient apparatus is supplied.

Prior to my experiments and the perfection of the invention now under consideration, the theory and practice of engineers and experts was reduced to the employment of two pipes, and, as far as possible, a separation of the steam and water resulting from condensation, thus rendering necessary two connections to each radiator and the employment of two valves, which required to be opened and closed simultaneously, or the radiators would become filled with water.

In the earlier stages of low-pressure steam heating a single pipe was tried, but the glaring defects of the arrangements (viz.: supplying the steam upward against the descending water of condensation, and thereby causing noise and an impeded circulation in both pipes and radiators,) soon caused the same to be abandoned. The latter practice and that in vogue prior to my invention, (viz.: the employment of two pipes, one to supply the steam, and the other to carry off the water of condensation,) while greatly increasing the cost, has not entirely removed the conflict of the elements thus brought into juxtaposition, for steam, air and water will not move harmoniously together until their relative specific gravities are duly considered and provision made therefor.

Under my system no conflict is possible, for the steam, being conducted from the generator through one or more vertical mains to a point above the heating devices, and from thence distributed downward, is always on the top of the denser and heavier elements, which, thus arranged, move on in harmony with the law of gravity, and without impediment, both in their passage from the radiators and in their return to the generator. It will be also evident to those at all conversant with the operation of steam heating that, once having conducted the steam to a point above the radiators, and arranged for the escape of the air at the lowest, (but above the water-line of the boiler,) the question of a perfect, noiseless circulation would be no longer a doubtful one.

A steam generator of any suitable character is placed in the cellar or basement of the structure to be heated; affixed to such generator is a main supply-pipe or conduit, which rises vertically and extends to a point in the building above or near which the highest radiator or coils are to be located. A steam radiator is placed in each or any of the stories of the structure, while a pipe extends from the upper part of the main supply-pipe, horizontally or slightly descending, to the side or other wall, thence directly downward to the lower part of the basement or cellar in which the generator is placed, and discharges into such generator. A pipe extends from the branch or return pipe to, and communicates with, each radiator at the upper part thereof, while the outlet or escape pipe of such radiators, leading from the bottom thereof, and for carrying off the water of condensation, connects with and discharges into the said drop pipe, as described.

At a point on the down or return pipe, below the first or lowest radiator, and above the water-line of the boiler—as, for instance, within the basement—I arrange a valve designed to permit the escape of air. This valve, when the apparatus is put in operation, is left open, so that the air expelled from the piping, and from the several radiators by the advancing steam, shall find vent at this point. The air will have been discharged when the steam begins to blow through the discharge pipe, at which time the valve should be closed. Thus I am enabled to provide one common vent for all the air that may be contained in the piping and radiators; and, furthermore, to locate this vent at a point

where the foul air and noxious gases can be got rid of without inconvenience to the occupants of the building. Heretofore it has been customary to provide each radiator with a vent, and the air has been discharged directly into the room in which the radiator was located.

The advantage of my venting arrangement, which is rendered practicable by my system of steam piping, is therefore apparent. A suitable coupling may be attached to the main supply-pipe in each story or division of the structure, the same being provided with a valve; to these couplings a hose may be attached, in case of fire, or through which steam may be discharged directly into the apartment, without the intervention of hose.

The operation of the above-described method is as follows:—Steam under pressure from the generator or boiler is conducted directly upward through the main supply-pipe until it reaches the return pipe, down which it descends until it reaches the connecting pipe of each radiator whose valve is open. After circulating through the same, and parting with its heat, it is condensed, and the resultant water flows through the outlet, or drip pipe, into the return pipe, and directly down the latter, without hinderance or check, where it is discharged into the generator.

Having described my invention, what I claim is:—

1. *The herein-described system of steam-heating, the same consisting in the combination of one or more main pipes, conveying the steam without distribution to a point above the radiators, with branch piping conveying the steam downward, and serving at one and the same time to supply steam to and conduct the water of condensation from the radiators, the steam, air and water moving together in one direction towards the boiler, as described.*

2. *In a system of steam-heating comprising an overhead supply, the combination of the radiators or coils with the branch or return piping entering below the water-line of the boiler, as described.*

3. *The combination, with a system of steam-piping and radiators connected therewith and operating as described, of an air-vent or valve located on the branch or return piping, at a point below the first or lowest radiator, but above the water-line of the boiler, as described.*

JOHN H. MILLS.

F. P. HALE, } *Witnesses.*
F. C. HALE, }

Specification forming part of Letters Patent, No. 154,561, dated Sept. 1, 1874.
Application filed March 17, 1874.

IMPROVEMENT IN CONNECTIONS FOR STEAM RADIATORS.

JOHN H. MILLS, BOSTON, MASS.

To all whom it may concern:

Be it known that I, JOHN H. MILLS, of Boston, in the County of Suffolk and State of Massachusetts, have invented a certain new and useful Improvements in Connections to Steam Radiators; and I do hereby declare the following to be a full, clear and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it.

My invention relates to improvements in the connections to steam radiators, and consists in the combination, with an overhead steam supply-pipe, of a single connection, and its valve, entering the bottom of the radiator, as will herein be more fully described.

Heretofore it has been common to employ two or more connecting pipes for radiators heated by steam, one of which pipes was used for the admittance of the steam, and another one for the discharge of the condensed water. It has also been common to use two valves for each radiator for the same purposes. This is objectionable, on account of expensive pipings, fittings and valves.

To avoid this difficulty and extra expense, I arrange and combine, *with an overhead steam supply-pipe, a single connection and a single valve that enters the radiator at its lowest point.* The single connecting pipe is placed in an inclined position, in such a manner that the valve or cut-off is a little higher than the end of the pipe where it enters the supply-pipe, so that the water of condensation may flow unobstructed from the radiator through the lower part of the connecting pipe, and

at the same time allow the steam to enter the radiator through the upper part of the connecting pipe.

Thus it will be seen that I am able to use a single connecting pipe, and its valve from the overhead supply-pipe, for the purpose of conveying the steam to the radiator and to allow the water of condensation exit therefrom without obstruction, and thereby dispense with additional pipes and valves.

Having thus fully described the nature and operation of my invention, what I claim is:—

In combination with an overhead steam supply-pipe, a single pipe and its valve entering the bottom of radiators, as and for the purpose herein set forth and described.

In testimony that I claim the foregoing, I have hereunto set my hand this 10th day of March, 1874.

JOHN H. MILLS.

ALBAN ANDREN,
GEO. E. PHELPS, } *Witnesses.*

TESTIMONIALS.

BOSTON, August 18, 1877.

MR. JOHN H. MILLS:

Dear Sir,—In reply to your inquiries as to our opinion of your new and improved method of constructing steam-heating apparatus, to which our attention was called some four years since, where the supply of steam from above, working the steam, air and water in one pipe, forward and downward toward the boiler, with a single connection and valve to each radiator, we then expressed the opinion that it was novel and correct in principle. We are of the same opinion now, after testing it fully in large and small buildings, and under varied conditions, with upright and horizontal pipes.

It has proved equally successful in large buildings, as proved in the Columbus Hospital for the Insane, where it is introduced with perfect success; the Memorial Hall at Cambridge; the Clarke Institute at Northampton, and others.

The new method is simple and easy of construction, less expensive, giving great satisfaction to the users, as well as to those who construct the apparatus.

That we have taken a large interest in your Company, and are working under a license from it, may be assurance to you of our full endorsement of the new system, which has only to be tried to convince all of its great value.

Yours truly,

WALWORTH M'F'G. CO.
BY C. C. WALWORTH, *Gen. Manager.*

COLUMBUS, OHIO, Jan. 19, 1876.

MR. JOHN H. MILLS:

Dear Sir,—In reply to your inquiry as to the probable difference of cost in the erection of the steam-heating apparatus at the Central Ohio Lunatic Asylum, between the usual method of using a double connection for the radiator and the "over-head supply," or single connection, for which you hold certain patents, I will say that I am unable at present to state the sum definitely; but, to the best of my judgment, it is a saving of at least two thousand ($2000.00) dollars—possibly more, but cannot be far from that sum.

I am fully conversant with your different methods or systems of running pipe, have adopted them, and am well convinced the economy and other advantages of the system will lead to its very general introduction.

Many of the disadvantages of the "double-pipe" system are avoided, and it is so much more simple that it commends itself to any intelligent man at once.

Yours very truly,

LEVI R. GREENE,
Con. Eng.

WESTFIELD, May 31, 1877.

MR. JOHN H. MILLS:

Sir,—Your "System of Steam-Piping" has been adopted by us on several jobs in Providence, and with satisfactory results. Have the same system in use in a portion of the Normal School Boarding-House at Westfield, Mass.; this gives excellent satisfaction, and the fact that but one valve on each radiator is all that is necessary, is very much in its favor. We have no doubt but it will be generally adopted by first-class concerns on first-class work, as soon as its merits are understood.

Yours truly,

H. B. SMITH & CO.

ELMIRA, N. Y., June 18, 1877.

MR. JOHN H. MILLS:

Dear Sir,—In reply to your inquiry as to my success in the application of your "System of Piping," I will say that it has been entirely successful wherever tried.

The first large building in which I introduced it was in the fall of 1873; the building, four stories high, having over 100 rooms, aggregating over 400,000 cubic feet, using only one 5-inch supply, has been thoroughly warmed throughout ever since the apparatus was erected, and to the entire satisfaction of all concerned.

In my own store I have tried it under the most unfavorable positions with all the different kind of radiators, reducing the size and increasing the length of the horizontal supply, until I am entirely satisfied that it can be worked as efficiently as the two lines ordinarily used.

Very truly yours,

E. H. COOK.

BUFFALO, N. Y., July 30, 1877.

JOHN H. MILLS, TRUSTEE,
"Mill's Steam-Heating Trust Association,"
BOSTON, MASS.

Dear Sir,—We have examined the papers you sent us relative to your new "System of Steam-Piping," and believe it is correct in principle, and an advance in the right direction. We will take ten (10) shares of stock and a license to use the system; also the agency for this city and vicinity.

Very respectfully yours,

HART, BALL & HART.

PROVIDENCE, R. I., Jan. 5, 1873.

MR. JOHN H. MILLS:

Dear Sir,—For the past twelve years I have been engaged in erecting low-pressure steam-heaters, both by direct and indirect radiation, and have always used both supply and drain pipes in all cases. At your suggestion, I heat the R. I. Trust Fund Company's building, using only one pipe, starting from the boiler and going direct to the highest point, then branching off to the different points, passing down through each room and connecting at the bottom of each radiator, and so on back to the boiler.

The result was: I could heat all the radiators with half a pound of steam at the boiler, and so easily did the steam pass through the pipes that not a particle of noise could be heard.

In piping for direct radiation, I shall always adopt your method where it is possible so to do, as I believe it preferable to any system I have ever seen.

Very truly yours,

J. H. WATSON,
Agent.