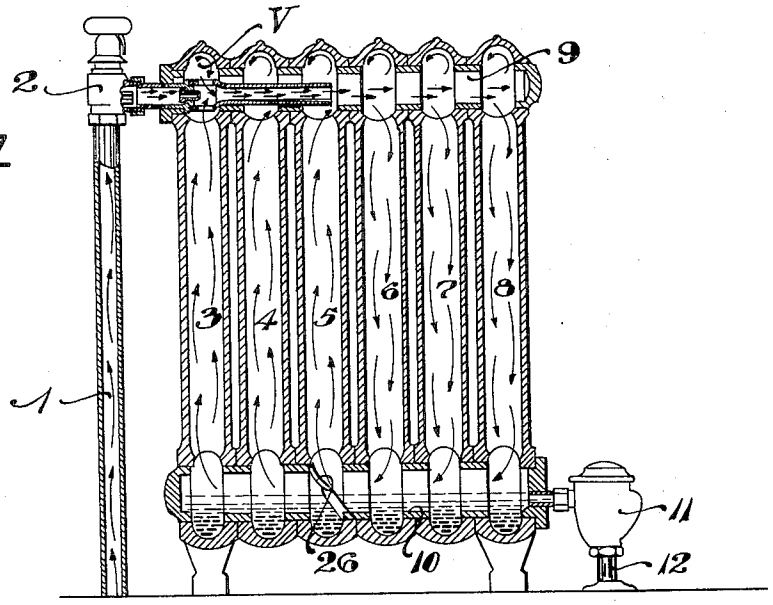
Jan. 9, 1934. S. J. PERRY 1,942,831

HEATING SYSTEM

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Fig. 1



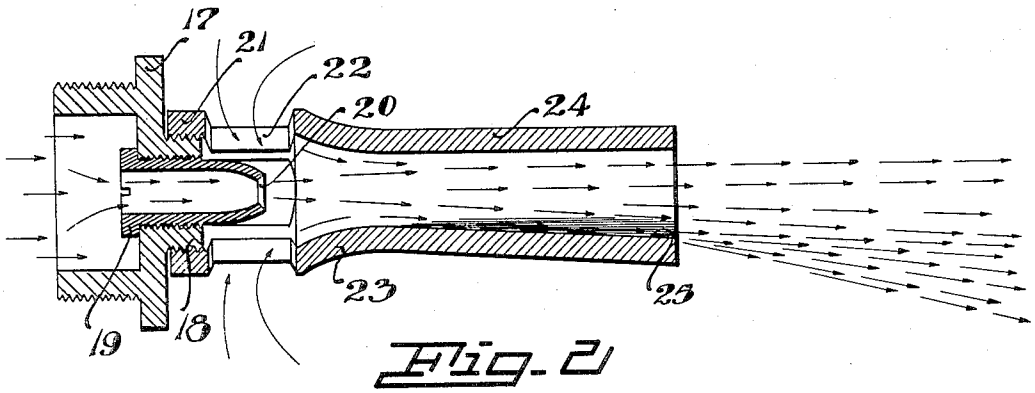


Fig. 2

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HEATING SYSTEM

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Fig. 3

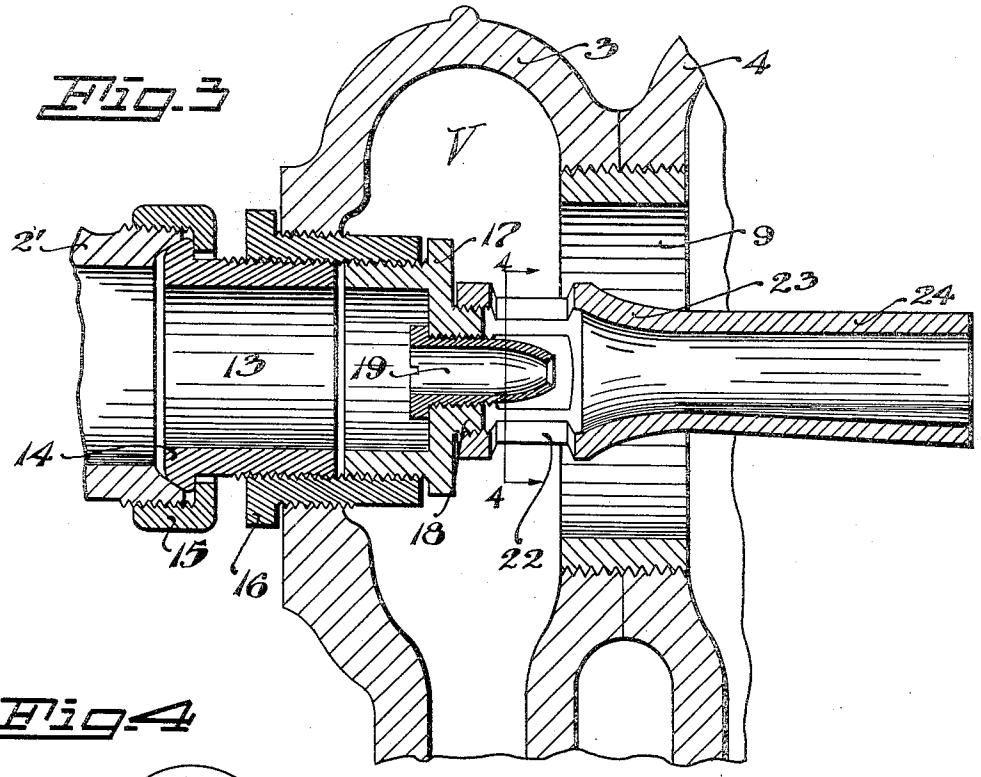
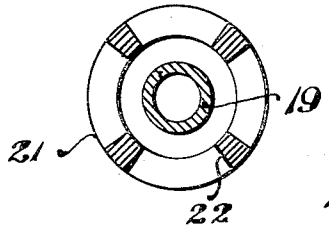


Fig. 4



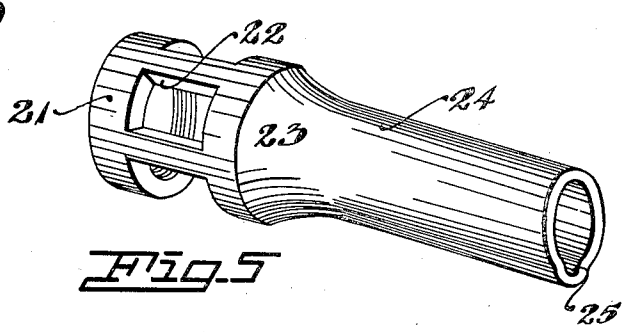


Fig. 5

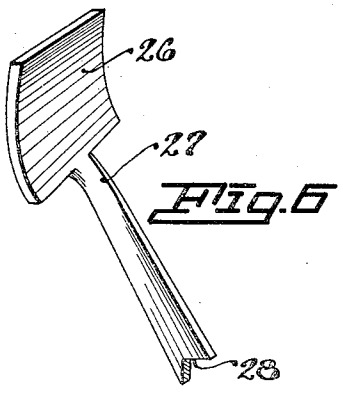


Fig. 6

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UNITED STATES PATENT OFFICE

1,942,831

HEATING SYSTEM

Sidney J. Perry, Spokane, Wash.

Application March 8, 1932. Serial No. 597,451

3 Claims. (Cl. 237—74)

My present invention relates to improvements in heating systems and while the invention is especially designed for use with, and is herein illustrated as a steam heating system, it will be understood that the invention is capable of use with various other types of heating systems for dwellings, hotels, apartment houses, and other buildings.

In carrying out my invention I provide a novel combination and arrangement of parts forming an equipment or outfit, and each of the radiators of the steam heating system is equipped with one of the outfits for feeding and circulating the steam in the radiator. The equipment for each radiator includes a steam injecting and circulating device which is substantially enclosed within the head of the radiator and the injector, which includes a practical minimum number of parts, may be assembled and installed with facility in any standard type of radiator, and the parts coupled or joined with the casing of the usual cut off valve, or with the steam inlet pipe, without materially altering the appearance of the fixtures.

The injector forms a rigid installation within the head of the radiator, and, after its initial adjustment, the injector requires no additional adjustment, although any necessary changes or replacements may be made with facility without dismantling the radiator.

The usual manually controlled, or automatically operating, cut-off valve is employed for individual control of each radiator, and the usual outlet trap, or similar means is employed for returning excess steam or water of condensation for re-heating.

The supply of steam for heating purposes to the radiators of the system is controlled, at the steam generating plant or boiler room, by varying or altering the steam pressure at the reducing valve of the boiler, within a wide range, to supply a small volume or quantity of steam for use in the heating system during mild weather, and a greater volume of steam when required for heating purposes in colder weather.

By the arrangement of the steam injector, which also performs the functions of a circulation-booster for the steam, within the radiators, a circulation of live steam is insured throughout the entire area of each radiator. During mild weather, when a minimum or small supply of steam at comparatively low temperature is supplied to the radiators, air and vapor within the radiators are mixed with the steam, and the warm, humid mixture is continuously and constantly circulated through all the columns of the radiator, thereby attaining results usually obtainable in hot-water heating systems, but not usually obtainable in steam-heating systems. During colder weather, the entire radiating surface of the radiator is heated by the thorough and constant circulation of the steam at high temperature.

The invention consists in certain novel combinations and arrangements of parts as will hereinafter be more fully set forth and claimed. In the accompanying drawings I have illustrated one complete example of the physical embodiment of my invention wherein I have illustrated combinations and arrangements of parts according to the best mode I have thus far devised for the practical application of the principles of my invention.

Figure 1 is a vertical sectional view of one of the radiators equipped with the steam injector and circulation-booster.

Figure 2 is an enlarged sectional view of the injector removed from the radiator.

Figure 3 is an enlarged sectional view at the head of the inlet or first column of a radiator, disclosing the combination and arrangement of parts including the vacuum chamber of the circulating system of the radiator.

Figure 4 is a sectional view at line 4—4 of Figure 3.

Figure 5 is a perspective view of the injector-tube detached.

Figure 6 is a perspective view of a deflector plate used in the bottom of the radiator to assist circulation at the central portion of the radiator.

In order that the general arrangement and utility of parts may readily be understood, I have shown in Figure 1 a standard type of steam radiator which is supplied with steam through the steam pipe 1 having a usual manual cut-off valve 2 and the nipple 2′ of the valve casing. The size and shape of the radiator may, of course, be varied, but for convenience of illustration I have shown a six-column radiator with columns 3, 4, 5, 6, 7, and 8, with the usual heads connected by the bushings or thimbles 9, and the bottom of the radiator also has the joint bushings 10. A trap 11 is connected with the outlet or lower end of the radiator, and a buoyant ball-valve therein controls flow of excess steam and water of condensation to the return pipe 12, but it will be understood that other means may be provided for outlet of excess steam or water.

In equipping the radiator with the injector and circulation-booster I employ a sleeve 13 that is

provided with exterior threads, and a joint flange 14, and the sleeve is rigidly joined with the nipple 2' of the valve casing 2 by means of the flanged nut 15 that is used to draw the sleeve against a seat of the nipple for a steam and air tight joint.

A flanged bushing 16 is threaded in a suitable opening in the head of the first column of the radiator, and this bushing is interiorly threaded to receive the exterior threads of the sleeve 13 which rigidly joins the pipe 1 with the radiator.

The inner end of the bushing projects into the space V, which forms a suction chamber or partial vacuum chamber at the rear of the injector, and an interior cap-nut 17 is threaded in the inner end of the bushing to close the end of the bushing within the chamber V. The cap-nut is fashioned with a central perforated boss 18 that is threaded to receive the threads of centrally disposed injector-nozzle 19, that is provided with a tapering mouth 20 through which the steam is injected from the steam pipe through the valve casing, the attaching sleeve 13 and the cap nut 17.

By means of the injector nozzle the steam is directed into and through a feed pipe of the Venturi type that extends through the upper head of the radiator for a suitable distance, here shown as a little less than half the length of the radiator, but the length of the feed pipe may be varied to suit different requirements and conditions.

This feed pipe or tube is fashioned with a cylindrical, interiorly threaded head 21 which is threaded on the exterior threads of the boss 18 of the cap-nut 17, and the head encloses the outlet end of the injector nozzle except for the presence of a number of short longitudinal slots 22, here shown as four in number and opening into a vacuum chamber V of the head of the column 3.

Directly in front of the mouth of the injector nozzle, the feed tube tapers at 23 into the cylindrical body 24 which as shown is less in diameter than the head of the tube, and the tube terminates with an open end at a suitable point in the length of the upper head of the radiator.

As best seen in Figures 2 and 5, an interior groove 25 is fashioned in the lower wall of the feed tube, and this groove starts at zero at substantially the finish of the tapered or Venturi portion of the tube, and increases in depth beyond the interior bore of the tube, to the end of the tube, for the purpose of permitting the blast of steam of the nozzle to spread downwardly, as indicated in Figure 2, by the arrows.

To assist in the circulation of warm currents or humid mixture, I preferably provide a deflector plate 26 of concavo-convex shape in the lower head of the radiator, say at the bottom of the third column in the radiator, and this plate is provided with a supporting leg 27 and a forked end 28. The forked end of the leg is located on an edge of one of the bushings or thimbles 10 and the plate leans against the upper edge of an adjoining bushing, in order that the plate may direct downwardly moving currents from the column 6, upwardly, into the adjoining column 5.

In Figure 1 it will be seen that steam rises through the pipe 1 and passes therefrom under control of the valve 2 into the comparatively large inlet chamber formed by the bushing 13, cap-nut 17 and the casing-nipple 2', and the volume of steam is compressed and its velocity is increased as the steam passes through nozzle 19. Steam issuing from the tapered mouth of the nozzle 19 is thus injected in a blast through the Venturi portion of the feed tube and the blast follows the arrows through the channel in the upper head of the radiator to start the circulation. The diverging walls of the bottom groove 25 of the feed tube, as best seen in Figure 2 direct some of the steam currents downwardly toward the columns 6, 7, and 8, and it will be apparent that the flow of steam follows the arrows through the columns to the lower channel of the radiator. Following the arrows in Figure 1, the steam rises upwardly from the lower channel into the three columns 5, 4, and 3, and in this manner the steam is uniformly and evenly distributed and circulated throughout the entire area of the radiator, thereby insuring heat radiation from the entire fixture.

In mild weather, when a small volume of steam at a comparatively low temperature is fed to the radiator, air within the radiator is mixed with the steam and the humid vapor is caused to circulate constantly and continuously. Currents of the humid mixture pass or flow upwardly through column 3 to the chamber V and thence through the ports or slots 22 to the interior of the head of the feed tube where these currents are subjected to the jet or blast from the nozzle, and again injected or recirculated through the radiator.

In cold weather, when a higher pressure of steam is supplied to the nozzle, the steam follows the same course, but the air is driven out through the trap 11 as the supply of steam continues and consequently, the entire area of the radiator is supplied with hot steam for radiation purposes.

In either mild or extremely cold weather a uniform temperature is thus maintained throughout the whole radiator, and the supply of steam at all times may be controlled and regulated from the boiler room of the steam-plant, and any desired radiator temperature may be maintained uniformly and steadily, subject of course to the use of the manually operated or automatically controlled valve of the radiator.

The expanding groove 25 of the feed tube and the deflector plate 26 in the bottom channel of the radiator are especially important as boosting agencies for circulation of steam, when the latter is supplied at low pressure and low temperature, as during mild weather. The jet of steam injected through the Venturi portion of the feed tube, aided by the expanding or outwardly flaring groove and the deflector plate, insure a positive flow of humid mixture through all of the columns or sections of the radiator, either downwardly or upwardly, and the circulation is thus steadily maintained throughout the entire area of the radiator. For mild weather I find that a pressure of steam as low as one-half a pound with a temperature as low as 160 degrees can be used.

Under increased pressure of steam and a higher temperature of the steam supplied to the radiator, the steady flow is maintained throughout the radiator and air is expelled from the radiator through the trap 11. At about 200 degrees temperature, the trap may close building up a back pressure, in the radiator of approximately eight or ten pounds, which will raise the temperature of the radiator to approximately 215 to 230 degrees.

Various alterations and changes may be made in the exemplified structures, as for instance, the trap may be eliminated, or different kinds of traps may be used; the size of the nozzle 19 may

be varied for larger or smaller quantities of steam without necessity for removing the entire device from the radiator, and of course, the valve 2 is closed when the injector device is being assembled or installed, or altered in the radiator, thus permitting continuous use of the heating system, although one of the radiators may be cut out of it.

The use of the injector devices in the radiators thus provides a steam heating system possessing all of the advantages of hot water heating systems and the added advantages of the steam-heating system, permitting control of the temperature of the radiators through a wide range of temperature, and maintaining a uniform heat throughout the entire area of the radiator. This uniform temperature in the radiator eliminates unequal expansion and contraction of the radiator parts, thereby avoiding leaks, and enhancing the durability of the radiator, and economy to a maximum degree is attained due to the fact that there is practically no loss of heat supplied to the radiators.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. The combination with a heat radiator having an upper header, a lower header, a plurality of columns connecting said headers and an automatically controlled outlet remote from the upper header, of an injector located in an inlet portion of the upper header, a steam supply for the injector, a steam tube extending from the injector into the upper header a sufficient distance to convey steam through the front portion of the upper header and permit downward flow of steam from the rear portion of said header, and means in the lower header for directing steam upwardly through the front portion of the radiator to create a continuous circulation of steam throughout the radiator.

2. The combination in a heat radiator having an upper header and an injector therefore, a steam supply for the injector, a lower header for the radiator, a plurality of columns connecting said headers, and an automatically controlled outlet in the lower header remote from the injector, of a steam tube projecting from the injector, said tube having a lower, interior groove increasing in cross-sectional area toward its outlet end for directing a flow of steam downwardly to a portion of the radiator, and means in the lower header for directing steam upwardly through another portion of the radiator to create a continuous circulation of steam throughout the radiator.

3. The combination in a heat radiator having an upper header, a lower header having an automatically controlled outlet therefrom, a plurality of columns connecting said headers, an injector for the upper head, and a steam tube projecting from the injector in the upper head, of means interior of the tube for directing a downward flow of steam through a portion of the radiator, a deflector plate, and means for supporting said plate in the lower header for directing steam upwardly through another portion of the radiator.

SIDNEY J. PERRY.