

M. J. FARQUHAR.
RADIATOR.

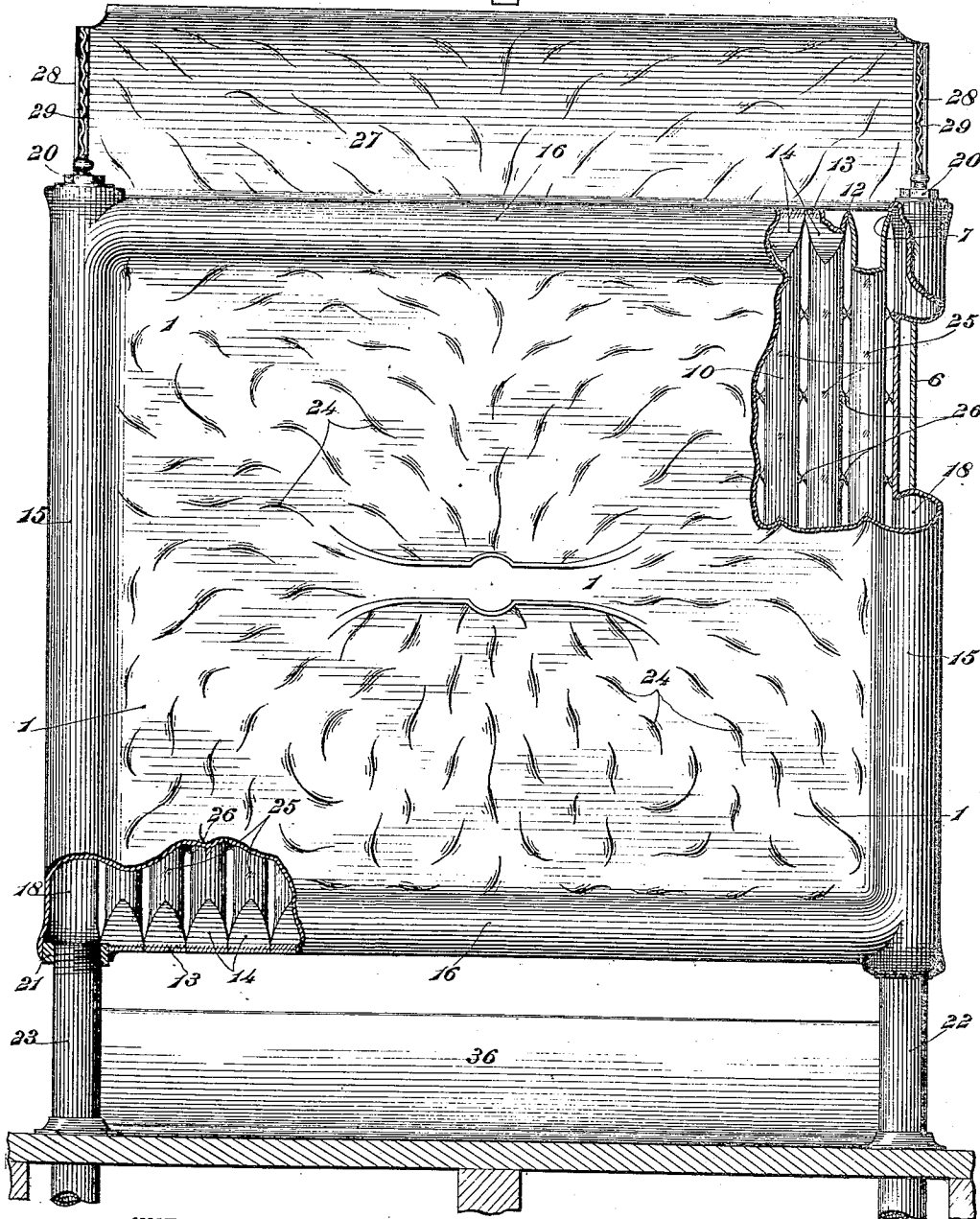
APPLICATION FILED MAY 14, 1909.

Patented July 15, 1913.

2 SHEETS—SHEET 1.

1,067,418.

Fig. 1.



WITNESSES

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2 SHEETS-SHEET 2.

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Fig. 3.

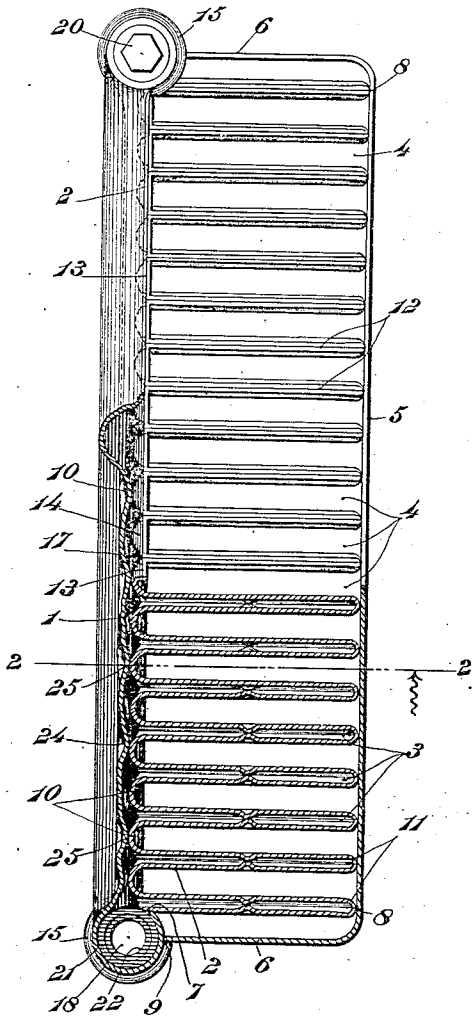
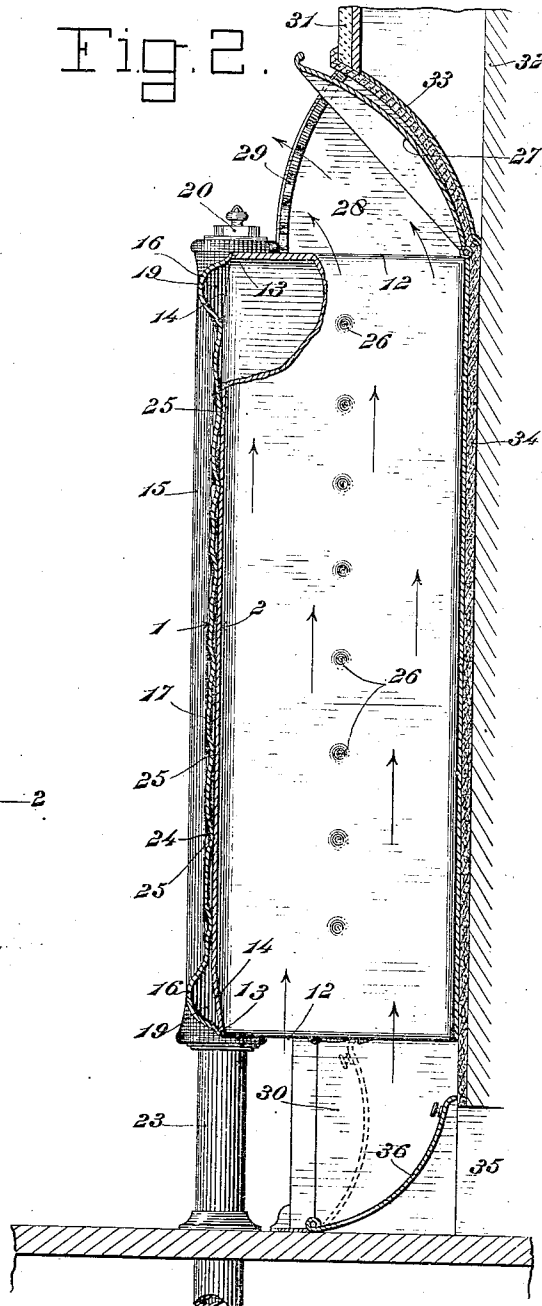


Fig. 2.



WITNESSES

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UNITED STATES PATENT OFFICE.

MILTON J. FARQUHAR, OF WILMINGTON, OHIO.

RADIATOR.

1,067,418.

Specification of Letters Patent.

Patented July 15, 1913.

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To all whom it may concern:

Be it known that I, MILTON J. FARQUHAR, a citizen of the United States, residing at Wilmington, in the county of Clinton and State of Ohio, have invented certain new and useful Improvements in 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 appertains to make and use the same.

The objects of my invention are to simplify and improve the construction of steam and hot water radiators; to provide a practicable construction which can be manufactured from sheet metal; to reduce the space occupied in the room; to eliminate the necessity of steam or water valves for controlling the heat; to provide for ventilation without risk of damage by frost; and especially to improve the operation and increase the efficiency of radiators by an increase of air circulation, better control of the heat, and avoidance of unsanitary accumulations of dust.

It has been the practice to construct radiators with the spaces for the heating fluid as large or larger than the spaces for the circulation of air and with the air spaces obstructed more or less at the top and base. For the best efficiency a construction is necessary that tends to keep the air in motion in a way to produce the most rapid changing of the molecules in contact with the air-heating surfaces, so as to avoid the scorching that renders the air unwholesome to breathe as well as to facilitate the rapid transmission of the heat. To accomplish this it is necessary that the air spaces be relatively large, upright, inclosed in chimney-like form, unobstructed and smooth.

The hollow spaces for the steam or hot water need be only just large enough to carry as much as the pipes leading to the radiator and to give free access to all portions of the metal heating-surfaces. Too much space increases the bulk and obtrusiveness of the radiator and the volume of the heating fluid required to fill it. The circulation of the heating fluid, steam or hot water, is impelled by a force many times stronger than the force of the air circulation, and the air is relatively the most rarefied substance. The enlarged volume of the circulating air effects a more thorough and

uniform distribution of heat and fresh air throughout the apartment.

For the foregoing reasons and objects, I have adopted a material and form of construction that lend themselves to a reduction of spaces for the heating fluid and to relatively large, smooth, unobstructed, chimney-like spaces for the circulation of air; sheet metal being employed, although I do not mean to confine myself essentially to this material, since my invention in its broader aspects may be embodied in a construction of cast-iron or other material.

In my improved construction, as represented in the accompanying drawings, the vertical air spaces are relatively large, are open at top and bottom, are inclosed at the back by a separate sheet, may be subdivided into smaller rectangular spaces by vertical cross partitions, and alternate with the relatively narrow spaces for the heating-fluid, which are closed at the top and bottom and back, but communicate at the front with a large common transverse space connected with the inlet and outlet pipes and inclosed by a metal front plate or sheet which is the only portion visible to the room, and which may be pressed into a panel, or into various arrangements of corrugations, or may be dotted with depressions to bring the front sheet into contact with the front edges of the air-chambers so that they can be tied together to resist the strain of internal pressure. The walls of the narrow spaces at right angles to the front plate may be tied together in like manner.

A large air valve or muffler at the top of the radiator gives control of the air circulation, hence of the heat conveyed into the room. When partially closed it reduces the heat transmission. When closed it practically stops all heat transmission except that of the front exterior surface, which is sufficient only to keep the room warm in mild weather. This control is simpler than the usual steam or water valves, less subject to misuse, mishap, leakage and wear, and better in the hands of the unskilled and more easily manipulated by automatic heat regulators. This muffler also serves as a deflector to direct the air currents away from the wall of the rooms.

At the base of the radiator there may be provided an opening either in the wall or floor for admitting fresh out-door air and a

valve for closing said opening or for controlling the volume of fresh air admitted. The absence of steam or water valves reduces the danger of freezing and the relatively narrow spaces for ice and the flexibility of the sheet metal eliminates the damage even in the event of freezing.

With the foregoing in view, the invention will now be described with reference to the accompanying drawings, which form a part of this specification, and then more particularly pointed out in the appended claims.

In said drawings, Figure 1 is a front elevation of a radiator embodying my invention, portions of the front plate being broken away to reveal the construction behind the same. Fig. 2 is a cross-section on line 2—2 of Fig. 3. Fig. 3 is partly a top plan view with the muffler removed and partly a horizontal section.

It should be understood that the following description is made with reference to the preferred form and sheet metal construction illustrated in the drawings, and without intention of limiting myself to any specific details or means and ways of constructing the parts of the radiator, except as hereinafter pointed out in the claims, since I reserve the right to such changes in form, arrangement or design and modification in details as may be comprehended within the spirit and scope of my invention.

An explanation of the illustrated construction is as follows: The body of the radiator is composed of a front sheet 1 and a back sheet 2, the latter being folded back and forth upon itself to provide a series of narrow heating spaces 3 alternating with a series of wide air spaces 4. See Fig. 3. The whole series of heat passages and alternating air spaces is inclosed at the rear and sides by a back sheet 5 having its ends 6 bent around and extending to the front sheet 1. The front bends of the folded sheet 2 confront the back surface of the front sheet 1, so that the folds of said sheet 2 and the alternating heat and air spaces extend at right angles to the front sheet, though the particular angle is not essential.

In practice, after the sheet 2 has been folded in the manner mentioned, the two sheets 1 and 2 are desirably made into an integral or single continuous sheet by welding, the seams or welded joints being indicated at 7. An alternative method would be to form the welded seams at 8, in which case the sheet 2 would comprise the folds or bends included between the two points 8, and the outer sides of the extreme heat passages 3 would be lateral extensions of the front sheet 1. The back sheet 5 may loosely inclose the structure, or the front edges of the sides 6 of said sheet may be welded to the front sheet at 9.

It will be noted that the sheet 2 is folded at the back to provide the narrow heat passages 3 and at the front to provide the wider air passages 4; in other words, the larger bends 10 of the structure are those at the front and which constitute the front walls of the air passages, while the smaller bends 11 are at the back and rearwardly close the heat passages. The heat passages 3 are closed at their tops and bottoms by bending the upper and lower edges of their walls together and joining or welding them at the seams indicated at 12, the effect of which is of course to form a continuous longitudinal joint or connection between the folds of the sheet 2, as indicated at 13, both at the top and bottom. In order to make these as straight joints, the upper and lower ends of the front bends 10 of the sheet 2 are flattened off as indicated at 14. At its opposite ends, the front sheet 1 is formed into vertical rolls or approximately tubular portions the edges of which meet and are joined to the edges of the folded sheet 2 at the welded seams 7 previously indicated; and at its top and bottom said front sheet is formed into semi-tubular rolls 16, the edges of which are welded to the front bends of the folded sheet 2 along the longitudinal joints 13; thus connecting the front sheet 1 to the top and bottom of the folded sheet 2 by continuous welded seam-joints. By this means, the front sheet 1 and folded sheet 2 are so joined at the sides and along the top and bottom at the front, as to provide across the entire series of heat spaces 3 and communicating therewith a large common heat-chamber 17, said chamber including the enlarged vertical passages 18 in the tubular portions 15 and enlarged horizontal passages 19 in the semi-tubular portions 16.

Stated differently, the radiator comprises a front wall 1 joined laterally and at the top and bottom to a back wall 2, providing an intermediate common heat-chamber 17, the back wall being formed with or constituted by a series of folds or forwardly-connected narrow heat-sections 3, communicating at the front with said heat-chamber 17, but closed at the top, back and bottom, and leaving wide, unobstructed air spaces 4 between the respective heat sections, which air spaces, being inclosed between the forward-connections or bends 10 of the said back wall 2 and another wall 5 placed behind the series of sections, make chimney-like passages for the circulation of the air.

The tubes 15 are closed at their tops by suitable caps 20, and the lower ends of said tubes are open and provided with rings or thimbles 21 in which are screwed or secured the upper ends of the steam or hot water pipes, that is, the inlet pipe 22 and the outlet pipe 23, upon which the radiator is sup-

ported. The back of the radiator is sufficiently supported by resting against the wall of the room in which it is installed.

Owing to the rolled or outwardly expanded form of the top, bottom and sides of the front sheet 1, the main portion of the sheet constitutes a depressed panel, and it may be mentioned that the sheet may be formed into the shape illustrated by the operation of pressing. The area of the panel is or may be formed with corrugations or depressions, arrangeable in many different ways, and contacting at spots with the front bends 10 of the folded sheet 2, at which spots the contacting surfaces are or may be joined or welded together so as to secure the entire front sheet of the radiator at various points or places to the folds of the sheet 2 and thus strengthen the structure and resist the strain of internal pressure. In the drawings, the corrugations or depressions are denoted by the numeral 24 and the spots or points at which they contact with and are welded to the bends of the sheet 2 are indicated at 25. As illustrated, the corrugations are in the form of light wavy depressions scattered over the sheet so as to give the visual effect of circulation; but as previously stated they may be arranged in various ways, as, for example, horizontally, obliquely, zigzag or other appropriately arranged corrugations, or in place of corrugations the front sheet may simply be indented at spots and welded to the bends of the folded sheet. For a similar reason, the folds of the sheet 2 are transversely connected, being preferably tied between the walls of the heat spaces 3. A preferred means is by indentating and welding the said walls at spots, as indicated at 26, but several alternative methods, among others, would be to insert and weld small metal pieces between said walls, or wires or rods shorter than the width of the heat spaces if arranged horizontally and shorter than the height of said spaces if arranged vertically therein; and it may also be stated that my broad invention includes the joining of the sheet metal parts by riveting or other suitable means of joining, both at the spots and the seams previously mentioned, although the welded spot and seam joints are much superior and in the connections stated are claimed as a feature of my invention.

In operation, the heating fluid supplied by the inlet pipe 22 fills the entire heat-chamber 17 including the passages 18 and 19 and the series of narrow heat spaces 3 in the folds or heat sections of the radiator body, and the heating fluid circulates up the right hand passage 18 and across through the upper passage 19 and through the entire heat-chamber 17 behind the front sheet or panel, into and out from the respective heat

spaces 3, leaving by the left hand passage 18 and lower passage 19 and passing out the outlet pipe 23; although of course the circulation is not confined to any particular course or courses as the entire heating chamber 17 is a common chamber in communication with all of the vertical heat spaces 3. Not only is there provided a very large radiating area or surface, which being of sheet metal all the more readily absorbs and transmits the heat, but as the heat passages are confined between closely arranged opposing walls throughout the apparatus, making an assemblage of thin, flat heat spaces, a less volume of the heating fluid is required to fill the passages and thoroughly heat the radiating surfaces, so that the heat is very effectively utilized, and as the smooth outer surfaces of the heat sections 3 are swept by comparatively voluminous air-currents ascending through the wide, chimney-like, and unobstructed passages 4 between the sections, the heat is most effectively taken up by the air-currents, the passages for which permit a rapid circulation and change of the molecules of air in contact with the radiating surfaces, thus effecting a rapid transmission of heat, avoiding the overheating or scorching of air by lingering in contact with hot metal, and furnishing a large volume of fresh heated air to the room.

Preferably to the top of the back plate 5, there is hinged or pivotally mounted an air-valve or muffler 27 providing a cover for the entire apparatus, that is for the space inclosed within the sides 6 and back of the plate 5, which cover when partially closed reduces the heat transmission by restricting the air circulation, and when wholly closed confines the air beneath it and practically stops all heat transmission except from the front exterior surface of the radiator, which is sufficient only to keep the room warm in mild weather. By the location of the muffler and its curved form, it also serves as a deflector to direct the heated air-currents away from the wall and into the interior of the room.

The muffler may be adjusted and secured in desired position by any suitable means, as, for example, by means of stiff hinges, but preferably the muffler is arranged between sector-shaped side plates 28 at the top of the radiator, one or both of which is or may be provided with a corrugated or toothed-like segment 29 with which the end or ends of the muffler engage frictionally, allowing the muffler to be moved up and down but holding it in the position to which it is adjusted.

Fig. 2 shows a preferred manner of installing the radiator in a recess 30 in the wall of the room or apartment. 31 denotes the inner wall and 32 the outer wall of

the building. 33 is a segmental hood secured in the wall at the top of the recess 30, said hood being formed or provided with the aforesaid side plates 28 which carry the corrugated segments. 34 is a sheet of asbestos placed behind the radiator. 35 is an opening in the wall at the base of the recess 30, for admitting fresh out-door air, and 36 is a valve for controlling the volume of air admitted, the valve being shown in closed position and an open position being indicated in dotted lines. It will be seen that this arrangement provides for efficient ventilation by supplying copious quantities of pure fresh air to the room and heating it as it enters.

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

1. A radiator having spaced sheet-metal plates providing therebetween a sealed heat chamber, one of said plates forming a substantially flat front for said chamber and the other plate forming a substantially flat back for the chamber and being folded to form rearwardly elongated narrow flat heat spaces and intervening wider air passages, the heat spaces communicating with said sealed heat chamber and being sealed at their upper and lower ends, and the air passages being open at their upper and lower ends.

2. A sheet-metal radiator comprising a sheet folded to provide a series of alternating heat spaces and air spaces, the heat spaces being closed at their tops and bottoms, a front sheet inclosing between it and said folded sheet a common heat chamber in communication with said heat spaces, and tie-connections between said front sheet and the front bends of said folded sheet.

3. A sheet-metal radiator comprising a sheet folded to provide a series of alternating heat spaces and air spaces, the heat spaces being closed at their tops and bottoms, and a front sheet, inclosing between it and said folded sheet a common heat chamber in communication with said heat spaces, the front sheet having depressions or indentations welded at spots to the front bends of the folded sheet.

4. In a sheet-metal radiator, a sheet folded to provide a series of spaces opening alternately at opposite sides, and another sheet secured to one face of said folded sheet to intersect the planes of the folds and form a sealed chamber with the folded sheet, said second sheet being welded at spots upon the adjacent folds of the folded sheet, and the spaces opening toward said second sheet being sealed at top and bottom.

5. In a sheet metal radiator of the character described, the combination of a sheet folded to provide a series of narrow heat spaces and intervening air spaces, the walls

of the heat spaces being welded together at their top and bottoms and intermediately welded together at spots, and a front sheet united to said first mentioned sheet so as to form a heat-chamber in communication with said narrow heat spaces and welded at spots to the front bends of said folded sheet.

6. A sheet metal radiator comprising a sheet folded to provide a series of alternating heat spaces and air spaces, the heat spaces being closed at their tops and bottoms, and a front sheet inclosing between it and said folded sheet a common heat chamber in communication with said heat spaces, said front sheet being joined at the top, sides and bottom to said folded sheet by continuous welded joints, and having indentations scattered over its area and welded at spots between front bends of said folded sheet.

7. A sheet metal radiator comprising a sheet folded to provide a series of alternating heat spaces and air spaces, the heat spaces opening at the front and having their walls joined together at the top and bottom edges, and the front bends of said folded sheet being flattened at the top and bottom so as to bring them together along continuous lines, and a front plate inclosing between it and said folded plate a common heat chamber in communication with said heat spaces, said front plate being joined to said folded plate at the top and bottom along said continuous lines and being joined thereto at the sides.

8. A sheet metal radiator comprising a sheet folded to provide a series of alternating heat spaces and air spaces, the heat spaces opening at the front and having their walls welded together at their top and bottom edges, and the front bends of said folded sheet being flattened at the top and bottom to bring them together along continuous lines, and a front sheet inclosing between it and said folded sheet a common heat chamber in communication with said heat spaces, said front sheet being welded to said folded sheet at the sides and at the top and bottom along said continuous lines.

9. A sheet metal radiator comprising a front sheet and a back sheet inclosing between them a heat chamber, the back sheet having a series of folds providing heat spaces in communication with said heat chamber and intervening air spaces, the heat spaces being closed at their tops and bottoms, the front sheet being joined to the folded sheet at the top, bottom and sides and being formed with upper, lower and lateral swells to provide enlarged vertical and transverse passages.

10. A sheet metal radiator comprising a front sheet and a back sheet inclosing between them a heat chamber, the back sheet having a series of folds providing heat

spaces in communication with said heat chamber and intervening air spaces, the heat spaces being closed at their tops and bottoms, the front sheet being joined to the
 5 folded sheet at the top, bottom and sides and being formed with upper, lower and lateral swells to provide enlarged, vertical and transverse passages, the lateral swells forming tubes closed at their tops and hav-
 10 ing their bottoms respectively connected to inlet and outlet pipes for the heating fluid.

11. A sheet metal radiator body made as a continuous sheet of metal and comprising a front and back joined directly to each
 15 other at the top and bottom, the back composed of a series of folds providing alternate heat spaces in communication with a common heat chamber inclosed by the front, and intervening air spaces, and the structure
 20 including upright tubular formations at the opposite sides thereof adapted for coupling to inlet and outlet pipes for heating fluid.

12. A radiator comprising a front, a back composed of a series of sheet metal folds
 25 providing heat spaces alternating with air spaces, the heat spaces being closed at the top and bottom and in communication with a source of heating fluid supply, and a casing inclosing the folds and open at the top
 30 and bottom to provide chimney-like air passages between the heat spaces, the casing passing across the back ends of the folds and around the sides of the end folds and secured to the side edges of the front and
 35 back.

13. A radiator comprising a front, a back composed of a series of sheet metal folds arranged to provide alternating narrow heat spaces and intervening wide air spaces, the

heat spaces being closed at the top and bot- 40
 tom and in communication with a source of heating fluid supply, and a casing inclos-
 ing the folds and open at the top and bot-
 tom, the casing passing across the back ends
 45 of the folds and around the sides of the end folds and secured to the side edges of the front and back.

14. A radiator comprising a front sheet, and a back sheet joined to the front sheet to form an inclosed space therebetween, the
 50 back sheet being folded back and forth upon itself to form a series of heating chambers, with intervening air spaces open at their
 tops and bottoms, a sheet secured to the rear of the folds of the back sheet and form-
 55 ing the intervening air spaces into chimney-like passages, and a muffler connected to the radiator over the tops of said air pas-
 sages and movable to and from them to cover or partially cover said passages.

15. A radiator comprising a body consist- 60
 ing of a single sheet metal plate folded to provide a series of narrow heat spaces and alternating air spaces open at top and
 bottom, the walls of said heat spaces having
 65 their upper and lower edges welded together and being also welded across the heat spaces intermediately in spots, and a front
 plate covering the fronts of said heat spaces and welded at spots to the folded plate be-
 70 tween the heat spaces.

In testimony whereof I affix my signature, in presence of two witnesses.

MILTON J. FARQUHAR.

Witnesses:

MELVILLE HYER,
 NATHAN M. LINTON.