United States Patent [19]

Sturgis

[11] **3,927,299**

[45] **Dec. 16, 1975**

[54] **SELF-CONTAINED ELECTRIC STEAM SPACE HEATING UNIT**

[76] Inventor: **Clifford M. Sturgis,** 1213 Westmoreland, Colorado Springs, Colo. 80907

[22] Filed: **Mar. 18, 1974**

[21] Appl. No.: **452,421**

[52] **U.S. Cl.** **219/365;** 126/101; 165/105; 165/182; 219/341; 219/368; 237/16

[51] **Int. Cl.²** **H05B 1/00;** F24H 3/06

[58] **Field of Search** 219/341, 365, 366–370; 237/16–18; 165/182, 105; 126/101

[56] **References Cited**

UNITED STATES PATENTS

1,289,052	12/1918	Allensby	237/16
1,514,453	11/1924	Freeman	237/16
1,625,989	4/1927	Duffie	219/341
1,852,252	4/1932	McIntosh	219/341 X
1,938,588	12/1933	Hansen	165/182 X
2,266,016	12/1941	Fisher	219/341
2,415,076	2/1947	Arnold	219/365
2,917,617	12/1959	Greubel	219/365
3,277,275	10/1966	Brusven	219/341 X
3,500,015	3/1970	Barbier	219/341
3,523,180	8/1970	Kennedy	237/16 X
3,640,456	2/1972	Sturgis	237/16

FOREIGN PATENTS OR APPLICATIONS

741,247	12/1932	France	237/16
113,840	3/1918	United Kingdom	237/16
183,642	4/1918	Canada	237/16

Primary Examiner—A. Bartis
Attorney, Agent, or Firm—Fishburn, Gold & Litman

[57] **ABSTRACT**

A self-contained electric steam space heating unit for heating an area does not require any permanent connection or attachment to a liquid source or a heat source and includes a boiler having inner and outer chambers connected at their lower portions for liquid flow and provided with an electric heating element for generating steam in the inner chamber. A radiator unit is provided having a plurality of risers extending between an upper manifold and a lower manifold communicating with the boiler outer chamber. A condenser member connects the upper manifold to the boiler outer chamber. Steam generated in the boiler inner chamber is supplied to the riser by a steam pipe extending through the lower manifold and having a discharge portion in each riser. Condensate is returned to the boiler outer chamber through the condenser member and lower manifold. The risers and condenser member each have a plurality of spaced U-shaped fins thereon positioned to direct the flow of air produced by a fan located above the radiator through a louvered front opening in a housing enclosing the unit.

5 Claims, 3 Drawing Figures

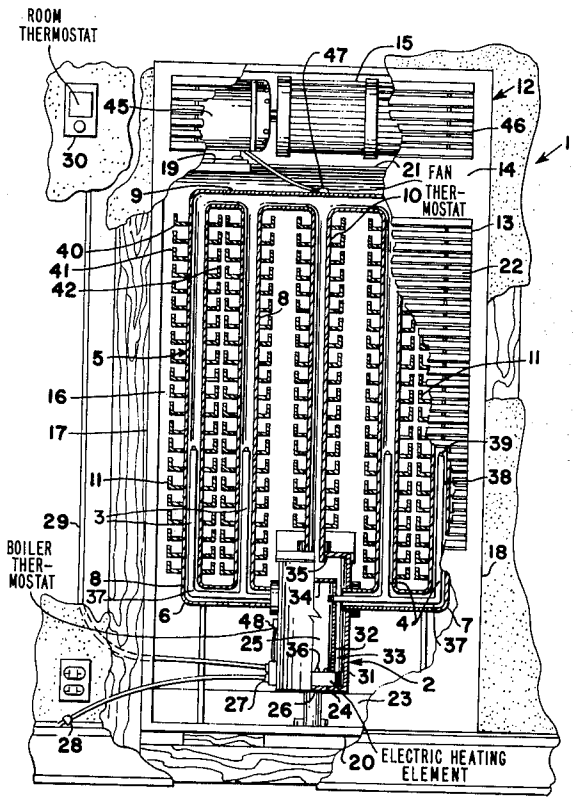


Fig. 1.

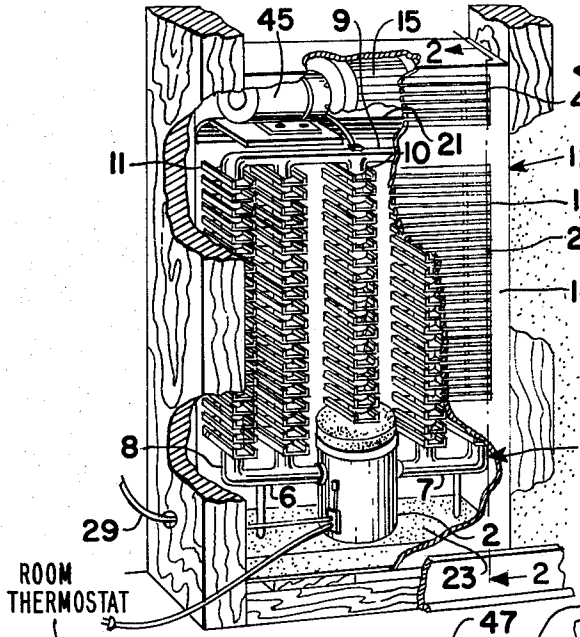


Fig. 2.

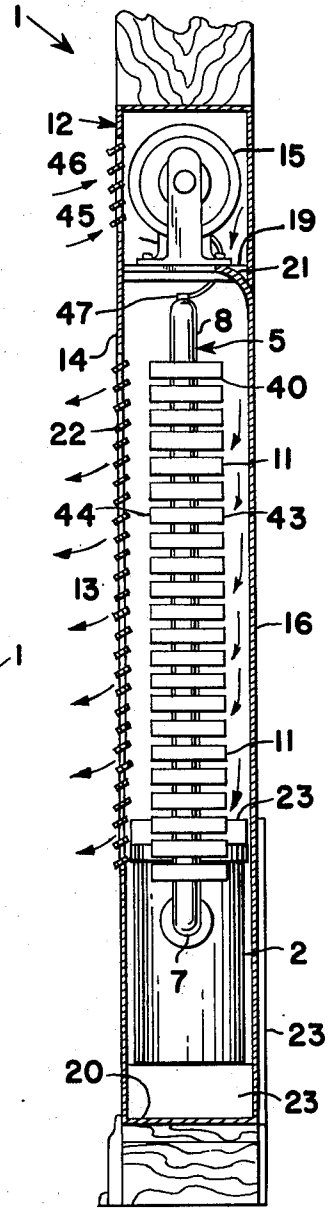
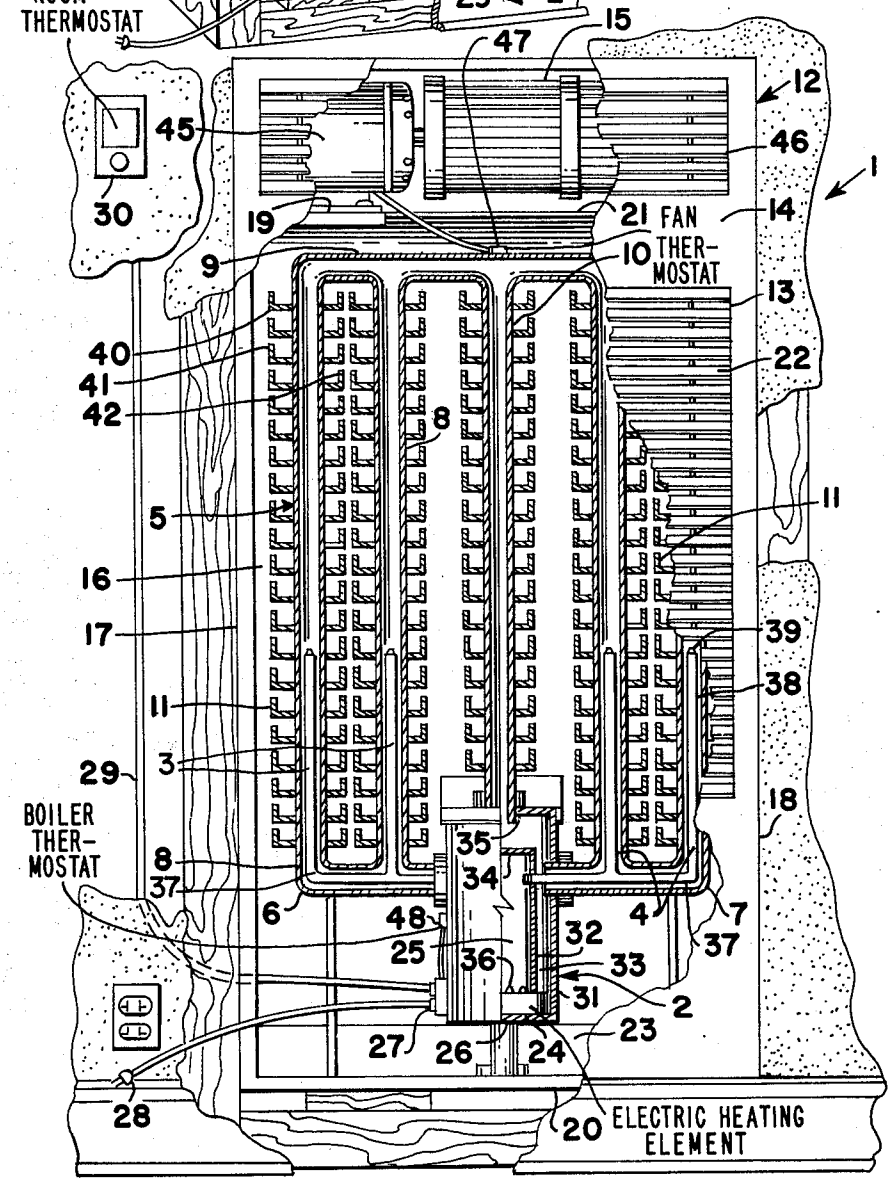


Fig. 3.



SELF-CONTAINED ELECTRIC STEAM SPACE HEATING UNIT

The present invention relates to steam heating units and more particularly to self-contained steam heating units operating at sub-atmospheric pressure and not requiring any permanent connection to a liquid source or a heat source and operative to effect flow of air around a vertical radiator unit and into an area or room to be heated.

The present invention is an improvement over the structure disclosed in U.S. Pat. No. 3,640,456 issued Feb. 8, 1972, to Clifford M. Sturgis for SELF-CONTAINED STEAM HEATING UNIT wherein the improvment includes forming a vertical radiator unit to include lower manifold members extending outwardly from a boiler and a plurality of risers extending between the lower manifold members and an upper manifold member and an upstanding condenser tube extending between the upper manifold member and the boiler and positioning heat dissipating fins or members on the risers and forming the heat dissipating members or fins to direct air around the radiator unit and into an area to be heated in response to operation of a fan positioned above the radiator unit.

The principal objects of the present invention are: to provide a steam heating unit which cooperates with the normal air flow in an area to be heated; to provide such a steam heating unit which delivers heated air to a lowest or coldest portion of an area or room to be heated, such as directing the heated air over a floor; to provide such a steam heating unit which is automatic in operation and starts a fan when temperature of a radiator unit is raised to a selected temperature and turns off a boiler when temperature therein rises above a selected temperature; to provide such a steam heating unit having a vertical radiator unit formed of lower manifold members extending outwardly from a boiler and a plurality of finned risers extending between the lower manifold members and an upper manifold member and an upstanding finned condenser tube extending between the upper manifold member and the boiler; to provide such a steam heating unit wherein the fins on the risers and on the condenser tube each have a base portion and opposed side portions extending between front and rear sides of the radiator unit whereby air must flow between the side portions and around the risers and condenser tube; to provide such a steam heating unit having a fan positioned above the vertical radiator unit to draw in air moving down a wall and move the air downwardly and around the risers and condenser tube and into an area or room to be heated; to provide such a steam heating unit which is a closed system and operates at sub-atmospheric pressure and is operative to induce flow of vapor and condensate within the system; to provide such a steam heating unit which is adapted to be recessed between studs of a building wall with a front wall thereof flush with the wall surface of the building wall; and to provide such a steam heating unit which is economical to manufacture, capable of continued effecient operation in providing suitable heat in an area or room to be heated, durable in construction, and particularly well adapted for the proposed use.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings

wherein are set forth, by way of illustration and example, certain embodiments of this invention.

The drawings constitute a part of the specification and include and exemplary embodiment of the present invention and illustrate various objects and features of the steam heating unit.

FIG. 1 is a perspective view of a cabinet enclosing a steam heating unit embodying features of the present invention mounted in a building wall and with portions of the wall and cabinet broken away to better illustrate the components of the steam heating unit.

FIG. 2 is a vertical sectional view through the structure taken on the line 2—2, FIG. 1.

FIG. 3 is an enlarged front elevational view of the building wall and steam heating unit therein with portions broken away to illustrate the structure thereof.

Referring more in detail to the drawings:

As required, detailed embodiments of the present invention are disclosed herein, however, it is to be understood that the disclosed embodiments are merely exemplary of the invention which may be embodied in various forms. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present invention in virtually any appropriately detailed structure.

In the disclosed embodiment of the present invention, the reference numeral **1** generally designates a self-contained closed system steam heating unit for heating an area or room. The steam heating unit **1** does not require any permanent connection or attachment to a liquid source or a heat source. The steam heating unit **1** includes a boiler **2** operative to form a vapor from a liquid for flow through vapor discharge members **3** and **4** extending from respective opposite sides of the boiler **2** and into a radiator **5** having lower manifold members **6** and **7** also extending from respective opposite sides of the boiler **2.** A plurality of risers **8** each extend between the lower manifold members **6** and **7** and an upper manifold member **9.** A condenser tube **10** extends between the upper manifold member **9** and the boiler **2.** The steam heating unit **1** operates at subatmospheric pressure and the risers **8** and the condenser tube **10** each have a plurality of spaced U-shaped heat dissipating members or fins **11** thereon positioned to direct flow of air from one side of the radiator unit **5** to the other side thereof. The steam heating unit **1** is enclosed within a housing **12** adapted to be recessed in a wall and the housing **12** has a louvered opening **13** in a front wall **14** for flow of air therethrough and into an area or room to be heated in response to operation of a fan **15** mounted on the housing **12** and positioned above the radiator unit **5.**

In the illustrated structure, the housing **12** includes a rear wall **16** spaced from and substantially parallel with the front wall **14** and side walls **17** and **18** extending between the front wall **14** and the rear wall **16.** The housing **12** includes a top wall **19** and a bottom wall **20** also each extending between the front wall **14** and the rear wall **16.** The top wall **19** has the fan **15** mounted thereon. The housing **12** also includes an arcuate or concave portion **21** connecting the top wall **19** and the rear wall **16** to direct air from the fan **15** toward the rear wall **16** and toward the rear side of the radiator unit **5.**

The louvered opening **13** in the front wall **14** of the housing **12** includes a plurality of spaced strips **22** ar-

ranged in the opening 13 to form a grill or louver like appearance. The front wall 14 also includes a solid portion positioned between the louvered opening 13 and adjacent the bottom wall 20 to cover and retain suitable insulation 23 positioned between the boiler 2 and the bottom wall 20.

The boiler 2 may be of any suitable form with a heater 24 arranged in a lower portion thereof to heat liquid within an inner liquid containing chamber 25. The heater 24 is preferably an electric immersion type heating element mounted on a bottom wall 26 of the boiler 2 and in sealed relation thereto with suitable electrical conductors extending therefrom in an insulated conductor member 27 to a connector or plug 28 adapted to be connected through a conductor 29 to a thermostat or heat responsive device 30 which functions in a conventional manner to interupt the circuit except when heat is needed in the area or room to be heated.

In the illustrated structure, the boiler 2 is generally cylindrical and the bottom wall 26 of the boiler 2 is suitably secured, as by a threaded connection, to an outer side wall 31 of the boiler 2 to form a sealed structure whereby when the electric circuit to the heater 24 is completed and the temperature in the area or room to be heated is such that the thermostat 30 calls for heat, the heating element 24 is energized.

The illustrated boiler 2 includes the inner steam chamber 25 which is formed by a side wall 32 spaced inwardly from the boiler outer side wall 31 to thereby define an outer or liquid receiving chamber 33 surrounding the inner chamber 25. The boiler 2 includes a top wall 34 closing the upper end of the inner steam chamber 25 and the top wall 34 is positioned adjacent a top wall 35 closing the outer chamber 33. The steam or vapor discharge members 3 and 4 communicate with the upper portion of the inner steam chamber 25 and extend outwardly therefrom into the radiator unit 5. A lower portion of the inner side wall 32 has a plurality of spaced openings 36 for movement of liquid from the liquid receiving chamber 33 to the inner steam chamber 25. When the heating element 24 is energized, the liquid in the bottom of the inner or steam chamber 25 is heated to a boil and the vapors rise in the steam chamber 25 and enter the steam or vapor discharge members 3 and 4.

The boiler 2 is positioned in the center of the steam heating unit 1 and in the illustrated structure, steam or vapor discharge members 3 and 4 extend outwardly from opposite sides of the boiler 2 and the steam or vapor discharge members 3 and 4 each have a base portion 37 extending substantially horizontally from the boiler 2 and one or more upstanding portions 38 extending upwardly from the base portion 37 and each received in a respective one of the risers 8 of the radiator unit 5. Each upstanding portion 38 has an upper end having a discharge orifice 39 in said upper end for flow of steam or vapor into the respective risers 8 of the radiator unit 2. The base portion 37 of each of the steam or vapor discharge members 3 and 4 has one end thereof communicating with the inner or steam chamber 25 to receive steam therefrom for flow into the radiator unit 5.

The radiator unit 5 is illustrated as an elongated substantially vertical member communicating with the outer liquid receiving chamber 33 of the boiler 2 and the radiator unit 5 has a flow passage therein and having a respective steam or vapor discharge member therein. The illustrated radiator unit 5 has the boiler 2 centered in a lower portion thereof and comprises a generally vertical structure having theh lower manifold members 6 and 7 extending outwardly from respective opposite sides of the boiler 2 and the lower manifold members 6 and 7 each have a respective base portion 37 of the steam discharge members 3 and 4 therein. The vertical radiator unit 5 includes the upper manifold member 9 which is spaced substantially above the boiler 2 and at least two upstanding members or risers 8 extend between the lower manifold members 6 and 7 and the upper manifold member 9. The upstanding members or risers 8 each have a respective upstanding portion 38 of one of the steam discharge members 3 and 4 therein.

The radiator unit 5 includes the condenser tube 10 which is positioned at the center of the radiator unit 5 and extends between the upper manifold member 9 and the top of the boiler 2. The condenser tube 10 has the lower end thereof extending through the top wall 35 of the boiler 2 whereby condensate formed in the condenser tube 10 will flow into the outer liquid receiving chamber 33 for return to the inner chamber 25.

The condenser tube 10 and each of the upstanding members or risers 8 of the radiator unit 5 have a plurality of the spaced heat dissipating members or fins 11 mounted thereon. The heat dissipating members or fins 11 each have a generally horizontal base portion 40 having opposite side edges extending substantially parallel with the side walls 17 and 18 of the housing 12. Spaced side members or portions 41 and 42 extend generally upwardly from a respective one of the side edges of the base portion 40 and the side portions 41 and 42 each extend between a rear side 43 and a front side 44 of the radiator unit 5 whereby the heat dissipating members or fins 11 each direct air from the rear side 43 of the radiator unit 5 and through the louvered opening 13 in the front wall 14 of the housing 12.

The fan 15 is mounted on the top wall 19 of the housing 12 thereby being positioned above the radiator unit 5 and the fan 15 is operative to move air downwardly toward the rear side 43 of the radiator unit 5 and then forwardly between the side portions 41 and 42 of the heat dissipating members or fins 11 and then outwardly through the louvered opening 13. The fan 15 is driven by a suitable motor 45 and is operative to draw in air flowing down a wall surface and then direct same around the radiator unit 5. The front wall 14 preferably has an opening having a suitable grate or louver 46 therein to permit the fan to draw air therethrough. The air is directed toward the arcuate or concave portion 21 between the top wall 19 and the rear wall 16.

The motor 45 of the fan 15 is electrically connected to a switch 47 which is also electrically connected to means responsive to temperature of the radiator unit 5 and operative to energize the motor 45 and thereby effect flow of air around the radiator unit 5 when the termperature of the radiator unit 5 is raised above a selected temperature, such as 160°F.

The steam heating unit 1 also includes means, such as a thermostat 48, responsive to temperature in the boiler 2 and operative to turn off same when the temperature of the heater 24 raises above a selected temperature, such as 300°F.

The steam heating unit 1 is particularly adapted to be positioned between the studs of a building wall, such as a residence wall, and the spacing between the front wall 14 and the rear wall 16 of the housing 12 is such that

insulating material may be positioned between the rear wall **16** of the housing **12** and the rear wall surface. The bottom wall **20** of the housing **12** is preferably mounted above the sub-floor of the room or area to be heated so that the housing **12** does not interfere with finishing, such as a baseboard, on the wall having the steam heating unit **1** mounted therein.

Operation of a steam heating unit constructed as illustrated and described is automatic and when the temperature in the area or room to be heated falls below a selected temperature, the thermostat **30** energizes the heater **24** thereby changing the liquid in the inner chamber **25** to vapor or steam which then flows through the steam discharge members **3** and **4** and then into the upstanding members or risers **8** of the radiator unit **5.** When the radiator unit **5** raises to a selected temperature, the switch **47** energizes the motor **45** which drives the fan **15** thereby effecting flow of air through the louvered opening **13** and into the area to be heated. The fan **15** is positioned above the radiator unit **2** and effects flow toward the rear wall **16** of the housing **12** and between the heat dissipating members or fins **11** thereby heating the air prior to flowing through the louvered opening **13.** Flow of the air around the upstanding members or risers **8** of the radiator unit **5** cools the radiator unit **5** such that condensate may form in the upstanding members or risers **8** and the condenser tube **10** and flow to the lower manifold members **6** and **7** for return to the outer or liquid receiving chamber **33** and then through the openings **36** and into the inner chamber **25** to be reheated and changed to steam or vapor.

The liquid for use in the steam heating unit **1** preferably includes a mixture in the range of approximately 30% water, 7% glycol and a suitable wetting agent. The glycol is preferably an anti-freeze or coolant in the form of ethylene glycol.

In the construction of the radiator unit **2,** all joints between elbows, tees, and other fittings with straight sections of pipe should be silver soldered, as gaskets will not remain pressure-tight. The radiator unit **5** and the boiler **2** are a closed system and operate at subatmospheric pressure which may be obtained by leaving a small hole in the upper manifold member **9** of the radiator unit **5** and heating the system until the heat dissipating members or fins **11** are too hot to touch and thereby forming vapor or steam which discharges through the small hole. The heating unit **24** is then turned off and the small hole is closed by a silver solder. The radiator unit **5** could be exhausted by a vacuum connection and then sealed in the same manner.

It is to be understood that while I have illustrated and described one form of my invention, it is not to be limited to the specific form or arrangement of parts herein described and shown.

What I claim and desire to secure by Letters Patent is:

1. A self-contained closed system steam heating unit comprising:

a. a boiler unit containing liquid to be vaporized and having inner and outer chambers with communicating passages at lower portions thereof for flow of liquid from the outer chamber to the inner chamber;

b. a heating element in the boiler and operative to heat the liquid and form steam in the inner chamber;

c. a radiator unit having a plurality of spaced apart upright tubular risers and an upper manifold connecting upper ends of the risers and communicating therewith;

d. a lower tubular manifold connecting lower ends of the risers and an upper portion of said boiler outer chamber for communication therebetween;

e. an upright tubular condenser member having an upper end communicating with the upper manifold in spaced relation to said risers and having a lower end communicating with an upper portion of said boiler outer chamber;

f. said lower manifold and upright condenser member forming flow passages for condensate to flow from the radiator unit to the outer chamber of the boiler;

g. an elongate steam discharge pipe having one end communicating with an upper portion of the boiler inner chamber and extending therefrom longitudinally within said lower tubular manifold and having discharge portions extending upwardly in lower portions of each of said risers with each discharge portion having an orifice discharging steam upwardly into the respective riser;

h. and means moving air around said upper manifold, risers and condenser tube to receive heat therefrom.

2. A self-contained closed steam heating unit as set forth in claim **1** wherein:

a. a major portion of said radiator unit is positioned above said boiler unit;

b. said tubular risers of said radiator unit and said tubular condenser member each have a plurality of longitudinally spaced heat dissipating fin members mounted thereon and extending outwardly thereof; and

c. said air moving means is a fan means positioned above said radiator unit and operative to effect flow of air to be heated downwardly over the upper manifold and around said risers and between the heat dissipating fin members thereon and into an area to be heated.

3. A self-contained closed system steam heating unit as set forth in claim **2** wherein:

a. said radiator unit has a rear side and a front side;

b. the front side of said radiator unit faces the area to be heated;

c. said heat dissipating fin members each have a generally horizontal base portion connected to and extending from the risers and having side edges and spaced side portions each extending generally upwardly from a respective one of the side edges of said respective base portion; and

d. the side portions of each of said dissipating members each extend between the rear side and the front side of said radiator unit whereby said heat dissipating members each direct air from the rear side toward the front side of said radiator unit and into the area to be heated.

4. A self-contained closed system heating unit as set forth in claim **3** wherein:

a. said radiator unit is enclosed within a housing having a front wall facing the area to be heated;

b. the front wall of said housing has a louvered opening therein for flow of air therethrough;

c. said major portion of the radiator unit is positioned adjacent the louvered opening in the front wall of said housing; and

d. said fan means for effecting flow of air is positioned above said radiator unit and moves air downwardly in the housing rearwardly of the radiator unit and then forwardly around the risers of said radiator unit and outwardly through the louvered opening in the front wall of said housing.

5. A self-contained closed system steam heating unit as set forth in claim **4** wherein:

a. said heating element is an immersion type electric heater at the bottom of the boiler inner chamber;

b. the boiler chambers and passages in the manifolds, risers, condenser tube member and steam discharge pipe define liquid and steam containing portions of the closed system and are at sub-atmospheric pressure when the radiator is at ambient temperature;

c. the discharge of steam from the steam discharge pipe orifice inducing circulation of vapors from said outer chamber through the riser, upper manifold and condenser tube member.

* * * * *