July 7, 1931. T. E. MURRAY 1,813,123

RADIATOR

Filed May 5, 1927

Fig. 1.

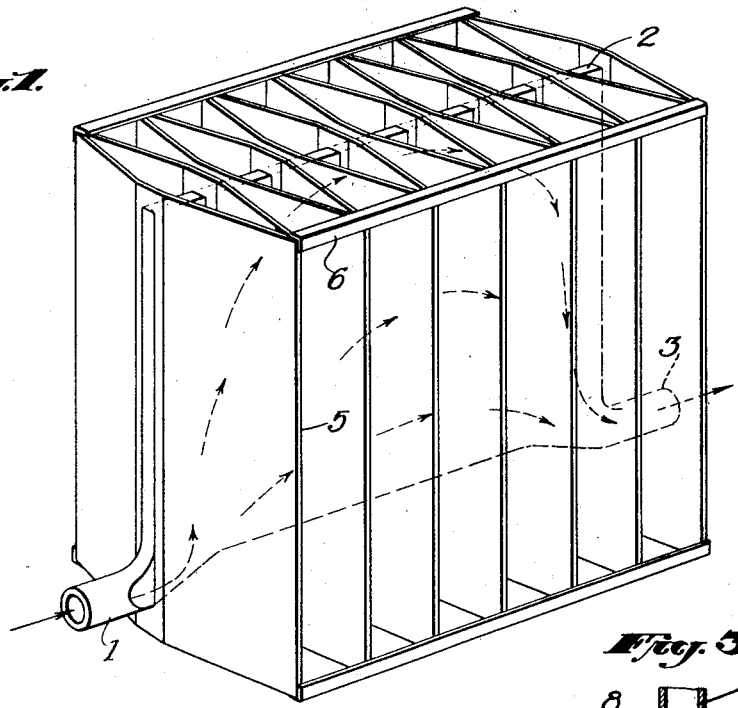


Fig. 3.

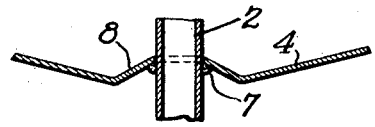


Fig. 2.

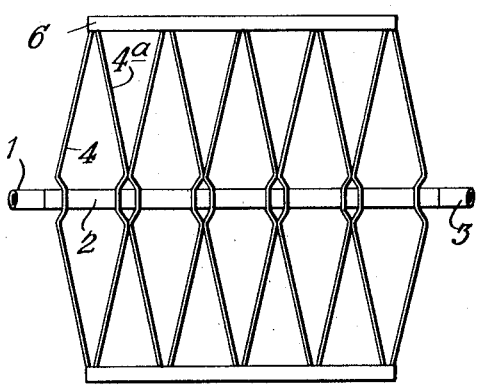


Fig. 4.

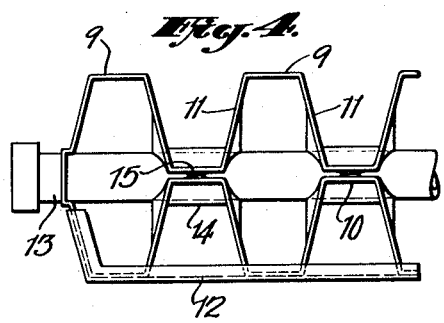


Fig. 5.

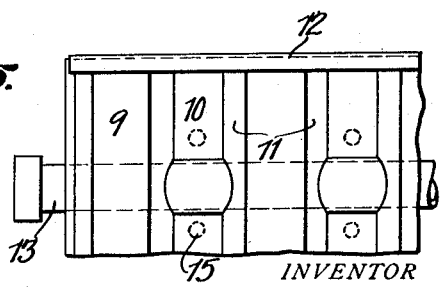
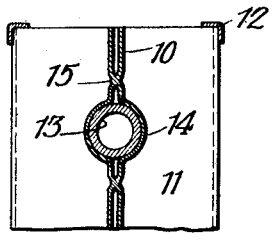


Fig. 6.



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Patented July 7, 1931 1,813,123

UNITED STATES PATENT OFFICE

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RADIATOR

Application filed May 5, 1927. Serial No. 188,890.

The invention relates to a style of radiator including a heating element and a radiating structure forming vertically extending flues for inducing an upward circulation of air. The accompanying drawings illustrate embodiments of the invention.

Fig. 1 is a perspective view of a complete radiator;

Fig. 2 is a plan of the same;

Fig. 3 is a horizontal section of a detail;

Figs. 4, 5 and 6 are respectively a plan, a side elevation and a cross-section illustrating a modification.

Referring to Figs. 1 to 3, a pipe 1 admits steam or other heating medium to a long narrow rectangular chamber 2 in which it gives up its heat or a considerable portion thereof, and from which it passes out by the outlet pipe 3.

The sides of the chamber are engaged by a radiating structure which conducts the heat out into the surrounding air. This is made of a series of plates 4 each of which extends laterally on both sides of the chamber. The plates are arranged in pairs 4 and 4^a, the plates of each pair being separated at the center and united at their outer edges 5, where they are braced by longitudinal braces 6, preferably in the form of angle bars embracing the corners of the radiating structure, and thus serving also to prevent accidental contact of a person with such corners. The braces 6 at the front and back respectively are not connected to each other. They may be light strips of just sufficient size to guard the sharp corners or to stiffen the angles; the radiating structure constituting the outermost portion of the radiator.

The plates 4 are fastened to the sides of the chamber and are welded or soldered to the latter as, for example, by arc-weld deposited metal 7. Each pair of plates makes approximately a diamond shaped figure in plan, and their central portions are retracted or bent inward as at 8 so that one pair may be brought close up to the next and still leave space for the welding operation.

Figs. 4 and 5 illustrate a different construction of the radiating structure which is better adapted for manufacturing and for applying to the heating element; and illustrate also a different type of heating element.

The radiating structure is made of sheets or plates corrugated in horizontal section. The corrugations may be of various shapes and proportions. As illustrated, the bent sheets are formed into outer and inner longitudinal plates 9 and 10 connected by transverse plates 11 which are similar in function to the plates 4 and 4^a of Fig. 2. They are in pairs separated at the center and united at their outer edges through the plates 9. The exposed edges of the plates at the outer angles of the corrugations are protected by braces 12 similar to the braces 6 of Fig. 2. Such a radiating structure may be applied to the steam chamber of Fig. 1 or to heating elements of various other types.

The heating element in Figs. 4 and 5 is a horizontal pipe 13 for steam or other heating medium. The radiator is best adapted for high temperature heating mediums. Instead of a steam pipe an electric heating element may be used such, for example, as those of rod or strip form carrying a resistance element encased in metal. Instead of a single pipe or heating element two or more such elements may be used, one above another.

The inner portions of the corrugations are stamped out to the form shown in Fig. 6 so as to provide recesses 14 embracing the pipe 13 and to make contact therewith over a considerable area. Corrugated plates thus shaped can be readily applied to the sides of the pipe and united intimately thereto by a metal connection as by welding or soldering. A coating of solder may be applied over the meeting faces of the pipe 13 with the parts 14. In addition, or as the sole means of attachment, the plates 10 may be drawn closely together above and below the pipe and united to each other by welds 15 (Fig. 6), or by bolts, rivets or other fastening means.

In certain locations it is not essential to have the radiating structure on both sides of the heating element. For such cases we would use only one of the corrugated plates of Fig. 4. Assuming such plates on both sides, the inner portions of the corrugations may

be spaced apart as shown in Fig. 4 or may be brought into contact across the top and bottom of the pipe. The plates 9 form closed vertical flues with the adjoining plates 11. The intermediate spaces which are open at the outside as shown in Fig. 4 may also be enclosed by supplementary plates or by a casing to increase the flue effect. And various other shapes may be given to the radiating structure to produce a similar flue effect.

A feature of greatest importance in connection with the invention is the composition and structure of the materials which are used. I prefer to use both for the heating element and for the radiating structure a metal of great heat conductivity. Copper, brass and zinc have in this respect a great superiority over the commoner metals, iron and steel. I prefer to use a cuprous metal (by which I mean copper or brass, bronze or other alloy of copper) and to use it in comparatively thin sheets; and I have found that in this way I can make a radiator of comparatively low cost, notwithstanding the extra cost of copper compared with steel, and of a greatly increased efficiency.

Where a heating chamber of the type shown in Fig. 1 is used, I prefer to make it of thin sheets of copper or the like and preferably of rolled sheets so as to secure a smooth interior surface for contact with the steam. And a comparatively thin chamber can be used and will take the heat from the thin stream of the heating medium very efficiently. I believe also that the use of rolled plates for the steam chamber will prevent the accumulation of air and the formation of air pockets therein, and will avoid the necessity of air valves which are now commonly used on radiators; but it will be understood that such air valves may be applied if found necessary. The pipe or pipes such as 13 are preferably of thin drawn copper tubing. Electric heaters are generally encased in steel. A casing of copper would give more rapid conduction of heat. But for such heating elements, and also for pipes 13 and chambers 2, steel or other metal may be used with good effect.

For the radiating structure I prefer to use electrolytically deposited plates of copper having a slightly rougher surface than the rolled plates and giving a better radiating surface to the air which passes up through the spaces between the plates, these spaces acting as a sort of chimney to aid circulation of air.

The walls of the heating chamber or steam pipe may be made the thinner because of the stiffening or reinforcing effect of the laterally extending radiating structure. I propose also to make the radiating structure of very thin metal. Its shape serves to make it very stiff in proportion to the cross-section of metal. The corner braces stiffen it at the edges and prevent accidental injury.

For the design of Figs. 1 to 3, I may use for the radiating structure plates of about one-sixteenth of an inch or less in thickness, and even as thin as one-sixty-fourth of an inch. Such plates can be extended outward from the heating chamber for a distance of more than one inch and up to about five inches. If this be between three and five inches, then I have found by experiment that the most economical distance between the centers of the successive chimneys or flues (spaces between the plates 4 and 4^a of each pair) is about two and one-quarter inches; and the width of such chimneys at their widest point should be not less than this distance, so as to allow for free access of air. Roughly, the radiating surface, exposed to the air, is about seven times as great as the surface exposed to the steam or other heating medium. It is understood that the radiator stands above the floor so as to provide easier access of air to the lower ends of the chimneys.

Experiments have shown that it is advantageous also to make the steam chamber narrow as indicated in the drawings. It may be, for example, of a width of as little as one-quarter of an inch, assuming the diameter of the inlet 1 to be one inch; the width of the chamber should be less than this so as to cause the steam to enter and leave the chamber at a comparatively high velocity, that is at a velocity greater than that at which it enters the chamber. This increased velocity gives a scrubbing action on the sides of the chamber which tends to assist in avoiding accumulation of air; and the velocity tends to prevent the accumulation of air pockets.

For the design of Fig. 4, having two steam pipes of one-half inch outside diameter drawn brass tubing, I have used a radiating structure made of rolled copper sheets four-thousandths of an inch thick. The depth of corrugations was one inch and the longitudinal distance between centers of closed flues (or plates 9) was two and one-quarter inches. Such a radiator was made of a size to perform the same duty (measured in condensation of steam) as a cast iron radiator of the common type. The radiator of this invention weighs one-fifteenth as much as the common type and is very much smaller.

The reduction in size is very advantageous in the saving of space in rooms where the radiators are installed. The reduced weight facilitates handling and installing, of course; and is particularly valuable in overbalancing the difference in cost between the two metals. The thinning of the plates increases the radiating surface in proportion to the weight of metal. Since the plates are not subjected to any substantial strain, being separate from the heating element itself, the thinning of them may be carried to a point which is

limited only by the requirements of conduction of heat outward from the heating element. Increased stiffness for a given weight may be secured by stamping small corrugations in the plates 9 and 11 of the radiating structure, and various other known methods of stiffening plates may be resorted to. These expedients will be particularly useful when the radiating structure is made of deposited copper instead of rolled sheets.

The use of thin sheets of copper or the like described above may be applied not only to the particular constructions disclosed herein, but to radiators of various other constructions; such for example, as those in my previous application No. 709,080 and Patent No. 1,699,542, January 22, 1929. It may be applied also to various similar structures for passing a heating medium through a chamber or pipe and heating the surrounding air by direct contact with such chamber without the aid of additional radiating structures; such for example, as are described in my previous application No. 643,941 and my previous Patents No. 1,633,601, June 28, 1927 and No. 1,715,378, June 4, 1929. And the radiators of Fig. 1 and similar designs have this advantage that they can be easily equipped with devices for heating by gas and with other devices for heating by electricity at the option of the user, the chamber in that case carrying a supply of water which is heated by the gas or electricity and which thus serves in a supplementary sense as the heating medium. A radiator thus equipped is described in a patent of mine No. 1,726,711, September 3, 1929.

It will be understood that a heating chamber of the type shown in connection with Fig. 1 may be used with a radiating structure such as I have described in connection with Fig. 4; and that such a radiating structure as is described in connection with Fig. 1 may be used in connection with a heating element or elements of the types described in connection with Fig. 4.

The radiator may be equally used for cooling air by circulating cold brine or the like through the pipes so that the latter become a heating element only in the negative sense, that is, they extract heat from the radiating structure and induce a flow of the cool air downward through the flues similar to the upward circulation of air induced by the passage of steam through the pipes.

An important feature of the invention is the great height of the transversely extending plates compared with their width. They form heated vertical air ducts which are unimpeded throughout their height, leaving a clear duct space between the transverse plates. The cool air enters the lower ends and open sides of the spaces between the closed flues and rises between the walls of the adjacent flues in the form of a horizontal series of vertical columns of air which are progressively heated on both sides by prolonged contact with the heated walls and are thus impelled rapidly upward so as to accelerate the circulation of the heated air columns upward from the ducts and throughout the room or inclosure to be heated. The spaces between the two plates which converge at their outer edges are not merely ducts but in fact flues closed in cross section and adapted to produce an even greater draft upward than the ducts between such flues.

The result of this structure of vertical ducts is that instead of a relatively stationary or slowly rising and laterally diffusing overheated body of air around a heating element, and unheated air in the remainder of the room or inclosure, there is obtained a greatly accelerated ascent of warm columns of air through the heated ducts and upward therefrom and thus a forced circulation and distribution of evenly heated air throughout the entire inclosure. And this effect is all the greater when the plates are made of thin cuprous metal, contributing a large contact surface to heat and accelerate the circulation of the air in the ducts and requiring a heater of extremely small size in comparison with the ordinary type of radiator for the same duty.

Various other modifications may be made by those skilled in the art without departure from the invention as defined in the following claims.

What I claim is:

1. A radiator including in combination a chamber for the heating medium and a sheet metal radiating structure engaging said chamber and comprising a series of plates extending horizontally on both sides of the chamber said plates being in pairs, the two plates of each pair being separated from each other at the center and united to each other at their outer edges, so as to form vertical flues for heating the air and inducing a draft and circulation of the heated air.

2. A radiator including in combination a chamber for the heating medium and a sheet metal radiating structure engaging said chamber and comprising a series of plates extending laterally on both sides of the chamber said plates being in pairs separated at the center and united at their outer edges, and braces engaging the longitudinal edges of said plates.

3. A radiator including in combination a chamber for the heating medium and a sheet metal radiating structure engaging said chamber and comprising a series of plates extending laterally on both sides of the chamber said plates being in pairs separated at the center and united at their outer edges, and braces engaging the longitudinal edges of said plates, and covering the corners thereof.

4. A stationary radiator for heating the air for a room having a chamber with thin, flexible, flat upright sides for steam or other high temperature heating medium and a radiating and stiffening structure united by a metal connection directly to the chamber and constituting the outer portion of the radiator and comprising a longitudinal series of thin plates extending outward from said chamber and forming with said chamber straight vertical flues open at top and bottom to induce an upward circulation of air through said radiating structure.

5. A stationary radiator for heating air and inducing an upward circulation thereof including in combination a chamber for steam or other high temperature heating medium made of thin cuprous metal and a radiating structure comprising thin plates at opposite sides of the chamber united by a metal connection to each other and extending outward from said chamber and upward and forming with said chamber vertical flues closed at the sides and open on top and bottom to induce an upward circulation of air through said radiating structure.

6. A stationary radiator for heating air and inducing an upward circulation thereof including in combination a chamber for steam or other high temperature heating medium and a radiating structure comprising thin plates of cuprous metal at opposite sides of the chamber united by a metal connection to each other and extending outward from said chamber and upward and forming with said chamber vertical flues closed at the sides and open on top and bottom to induce an upward circulation of air through said radiating structure.

7. A stationary radiator for heating air and inducing an upward circulation thereof including in combination a chamber for steam or other high temperature heating medium made of thin cuprous metal and a radiating structure comprising thin plates of cuprous metal at opposite sides of the chamber united by a metal connection to each other and extending outward from said chamber and upward and forming with said chamber vertical flues closed at the sides and open on top and bottom to induce an upward circulation of air through said radiating structure.

8. A heater including in combination a horizontally extending heating element and an extended-area structure engaging the same and comprising a longitudinal series of transverse heat conducting plates of thin cuprous metal fixed to the heating element in heat conducting relation thereto, said plates extending vertically beyond the heating element so as to provide correspondingly extended air-heating surfaces, said plates being substantially free of intervening obstructions and having a height relatively great compared to their width and forming a longitudinal series of unimpeded heated vertical air ducts.

9. A radiator including in combination a chamber for the heating medium of substantially greater height than width and made of sheet metal so thin in proportion to its other dimensions as to be capable of flexing under the internal pressure and a radiating structure applied directly to the opposite upright sides of said chamber and constituting the outer portion of the radiator and comprising a longitudinal series of thin plates extending lengthwise along the side of the chamber with vertical air passages between them and extending laterally outward from said chamber so as to form transverse ribs which by their shape stiffen said thin walls against flexing and distorting the chamber.

10. A heater including in combination a horizontally extending heating element and an extended-area structure engaging the same and comprising a longitudinal series of transverse heat conducting plates, each plate extending on both sides of and being fixed to the heating element in heat conducting relation thereto, said plates being substantially free of intervening obstructions and having a height relatively great compared to their width and forming a longitudinal series of unimpeded heated vertical air ducts.

11. A stationary radiator for heating the air of a room having a chamber for the heating medium with flat upright sheet metal sides and a radiating structure united by a metal connection directly to the sides of said chamber and constituting the outer portion of the radiator and comprising a longitudinal series of thin plates extending outward from said chamber with vertical passages between them for inducing an upward circulation of the heated air.

In witness whereof, I have hereunto signed my name.

THOMAS E. MURRAY.