Feb. 17, 1931. G. H. PHELPS 1,793,244

RADIATOR

Original Filed Nov. 3, 1925

Fig. 1.

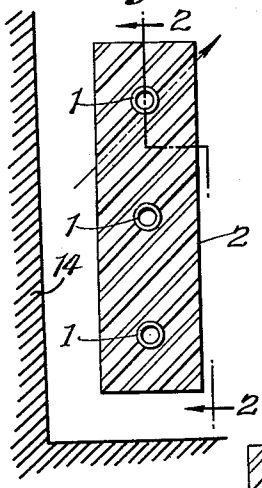


Fig. 2.

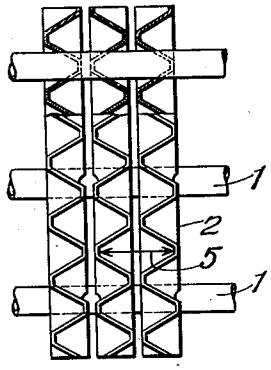


Fig. 3.

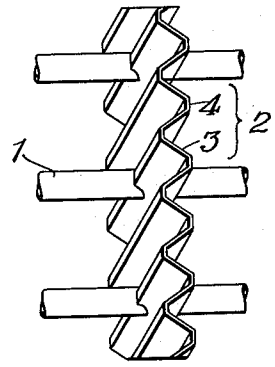


Fig. 4.

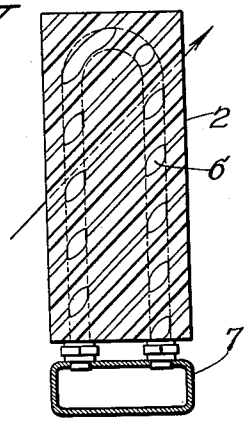


Fig. 5.

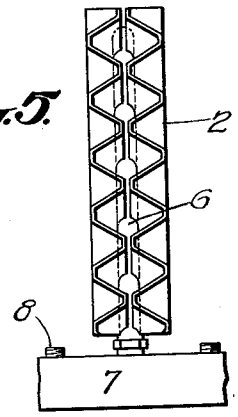


Fig. 6.

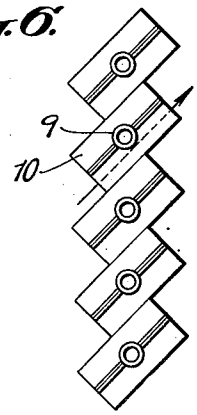


Fig. 7.

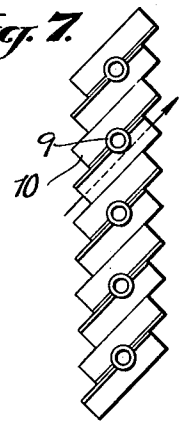
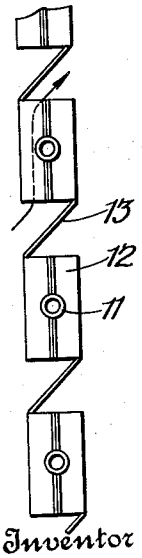


Fig. 8.



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By His Attorney

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Patented Feb. 17, 1931 1,793,244

UNITED STATES PATENT OFFICE

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RADIATOR

Application filed November 3, 1925, Serial No. 66,444. Renewed October 11, 1930.

This invention aims to provide a type of radiators and similar apparatus of high efficiency in proportion to their size. The accompanying drawings illustrate embodiments thereof.

Fig. 1 is an end view of the principal parts of a radiator;

Fig. 2 is a face elevation and a partial section of the same on the lime 2—2 of Fig. 1;

Fig. 3 is a perspective view of a part of the same;

Figs. 4 and 5 are respectively, an end view and a front view of another style;

Figs. 6, 7 and 8 are end views of still other styles.

In certain previous applications of Thomas E. Murray, there are described radiators with a pipe or vessel for the steam or other heating medium to which is applied a radiating structure of sheets or fins forming vertical flues to facilitate the upward flow and escape of the air as it is heated; the radiating structure being generally composed of thin sheet metal bent to shape and particularly of thin sheet copper, which conducts the heat and transmits it rapidly to the air. I have found that radiators of this general type, heat the air so rapidly as to be most efficient when the height or length of the air flues is comparatively small. For example, a radiator with flues twenty-one inches high caused a rise in temperature within the bottom fifth of the height equal to very nearly one-half the total rise in passing through the whole flue. Similarly the second fifth of the flue height raised the air temperature approximately one-half of its remaining total rise, and so on. The top fifth contributes very little heat to the air within the flues. And additions in height would contribute still less; though they would increase the radiation on the outside and would slightly increase the air velocity and the work done by the lower sections.

According to my invention I secure increased efficiency by carrying the air a short distance and heating it to a moderate temperature, keeping the difference in temperature (between the metal and the air) as large as possible at all points in the radiator. Successive streams of fresh air are supplied to the radiator flues at different levels so as to heat a comparatively large quantity of air through a comparatively small rise in temperature. The larger the quantity of air and the smaller the consequent rise in temperature, the more efficient the radiator. The air may be fed in at different levels in separate streams which are combined at one outlet, or may be fed in through a single inlet and let out in separate streams at different levels; but preferably it is both supplied at different levels and emitted at different levels. In this way radiators of standard or comparatively great height can be operated most efficiently.

The accompanying drawings are largely diagrammatic, generally omitting headers and other accessories, and the vessels and arrangement of fins or plates illustrated are merely typical of a large variety of designs to which the invention may be applied.

The radiator of Fig. 1 shows the vessels for the heating medium as tubes 1 which may be connected in series by connections at alternate ends, or in multiple by common headers at both ends. The tubes are arranged horizontally. In vertical transverse planes are sheets indicated as a whole at 2. One of these is shown separately in Fig. 3 and is bent or corrugated to form oppositely inclined plates 3 connected at their alternate edges by short vertical plates 4. The tubes 1 pass through the sheets 2 making a close fit, and may be soldered or welded to the plates for better transmission of heat. The corrugations are inclined at a substantial angle to the horizontal so as to form flues or guiding channels for the air, preferably inclined upward toward the front of the radiator so that when the radiator is against a wall 14, (Fig. 1) the warm air will be emitted toward the center of the room. A single corrugated sheet as in Fig. 3 provides a sort of open flue to direct the air as desired. Preferably, however, a number of such sheets are arranged close together as in Fig. 2 so as to provide substantially closed flues 5. The angle of the flues is sufficient to cause the air to circulate freely from back

to front. No matter how high such a radiator be built, and this is important in adapting it to certain spaces in a room, the length of the air flues remains constant, and each flue receives fresh unheated air from the back of the radiator and discharges its heated air into the room from the front. The efficiency of such a radiator is high and does not vary greatly from top to bottom of the radiator. The angle of the flues may be about 45 to 60 degrees with the horizontal. The width of the sheets forms the width or thickness of the radiator. The radiator may be made of any length by the application of a sufficient number of the sheets 2.

Figs. 4 and 5 illustrate the use of vertical steam tubes 6 passing between and in close contact with sheets 2 arranged in the same way as in Fig. 2. The contact is secured by bending out the sheets at the inner angles of the corrugations, as shown in Figs. 6 to 8 and as described more fully in the prior Murray applications referred to above. Each tube is in two lengths bent at the top with its two ends communicating with a box or header 7. Each pair of tubes with its two corrugated sheets would be a separate unit and several such units could be mounted on the nipples 8 on the top of the header, Fig. 5.

Fig. 6 shows the idea applied to a series of short units each comprising a length of pipe 9 passing transversely between inclined corrugated plates 10 similar to that shown in Fig. 3, so that the air will pass through flues in the direction of the arrow. The inner portion of the plates are bent at 10^a so as to enclose the pipes.

Fig. 7 shows similar pipes 9 and plates 10. But the plates of each pair are offset at their ends instead of having their ends in line as in Fig. 6.

The same result is accomplished by the arrangement of Fig. 8. The tubes 11 are enclosed by sheets 12 similar to those of Fig. 3 but corrugated so as to form vertical flues. The ends of each unit thus formed are open so that the air flues are vertical. The units are separated from each other and inclined baffles 13 are arranged between them to provide in effect inclined passages for the discharge of warm air at the front and the admission of cool air at the back to each unit separately.

This type of construction permits of the making of very thin radiators, which will occupy very little floor space. Owing to the inclination of the air flues these can be made of larger cross-section than in radiators of the standard type and the same over all thickness.

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

The advantage previously referred to of heating the air most efficiently when the height or length of the air flues is comparatively small is secured to a maximum extent by the arrangement illustrated because there is a single steam pipe (or it may be a single equivalent heating element) in the length of such flues. The flues extend beyond the pipe a sufficient length to secure the maximum efficient heating effect from such pipe. Increased efficiency, as well as economy in manufacture is secured by applying each of the sheets of the radiating structure to one of the opposite sides of the pipe as in Figs. 4 to 8 instead of passing the pipe through holes in the sheets as in Figs. 1 to 3. By applying sheets to the opposite sides of the pipe they can be pressed against the same firmly so as to secure intimate contact between the surfaces of the sheet and of the pipe.

There are also advantages in efficiency and in economy of manufacture in making up the complete radiator of separate units assembled together, each unit comprising such a single steam pipe with its radiating structure. The thin copper which is preferred for the radiating structure and other sheet metals can be bought much more cheaply in compartively narrow coiled strips suitable for such units than in wide sheets. This is because a narrow strip can be rolled down to a thin cross-section with greater ease than a wide sheet. These thin strips are made and sold in coils or rolls and are easily handled and cut into desired lengths. Such thin strips can also be economically and rapidly bent to the corrugated shape with very little manual work and no waste of material.

The radiator may be equally used for cooling air by circulating cold brine or the like through the pipes so that the latter becomes 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.

In Murray Patent No. 1,744,078 of January 21, 1930, there is disclosed a complete radiator of a height approximating its length with a single horizontal tube embraced between corrugated plates. Such radiators however will generally have more than one length of pipe in their full height. The present invention, as ambodied in Figs. 6, 7 and 8, is an improvement on the aforesaid Murray construction and is distinguished by units in which the height is not more than about twice the thickness from front to back so that a plurality of such units is required to make up a radiator of standard proportions, whether the units be vertical as in Fig. 8 or inclined as in Figs. 6 and 7.

What I claim is:

1. A radiator comprising a number of similar units assembled together each comprising a single heating element and a radiating structure comprising separate plates applied to the opposite sides of the heating element and forming flues closed at the sides and open at the ends and extending beyond the latter so as to provide an extended heating surface for the air and to induce substantial drafts of air through such flues of each unit separate from those of the other units.

2. A radiator comprising a number of separate units assembled together each including a heating element and a radiating structure applied thereto and forming flues for heating the air and inducing a draft of air through such flues, closed at the sides and open at the ends, the units being assembled in line with each other in the direction of such flues and means for receiving air in each unit and delivering it therefrom independently of the other units.

3. A radiator comprising a number of separate units assembled together each including a heating element and a radiating structure applied thereto and forming flues for heating the air and inducing a draft of air through such flues, said flues being closed at the sides and open at the lower and upper ends for entrance and exit of air, the units being assembled in line with each other in the direction of such flues and with a space between the exit from the flues of one unit and the entrance to the flues of the next unit.

4. A radiator comprising a number of separate units assembled together each including a heating element and a radiating structure applied thereto and forming flues for heating the air and inducing a draft of air through such flues, the units being assembled in line with each other in the direction of such flues and with a space between the exit from the flues of one unit and the entrance to the flues of the next unit and with deflecting means between successive units so as to deflect the heated air from one unit in one direction and to take the incoming air from the opposite direction to the next unit.

5. A radiator unit comprising a single horizontally extending heating element of substantially equal height and width and a radiating structure comprising plates applied to the opposite sides of the heating element and corrugated to form flues closed at the sides and open at the ends and extending beyond the heating element so as to provide an extended heating surface for the air and to induce a substantial draft of such heated air through the flues, the height of such unit being not more than about twice its thickness so that a plurality of units may be assembled vertically to form a radiator of standard proportions.

6. A radiator composed of a plurality of units as described in claim 5 assembled one above another.

In witness whereof I have hereunto signed my name.

GEORGE H. PHELPS.