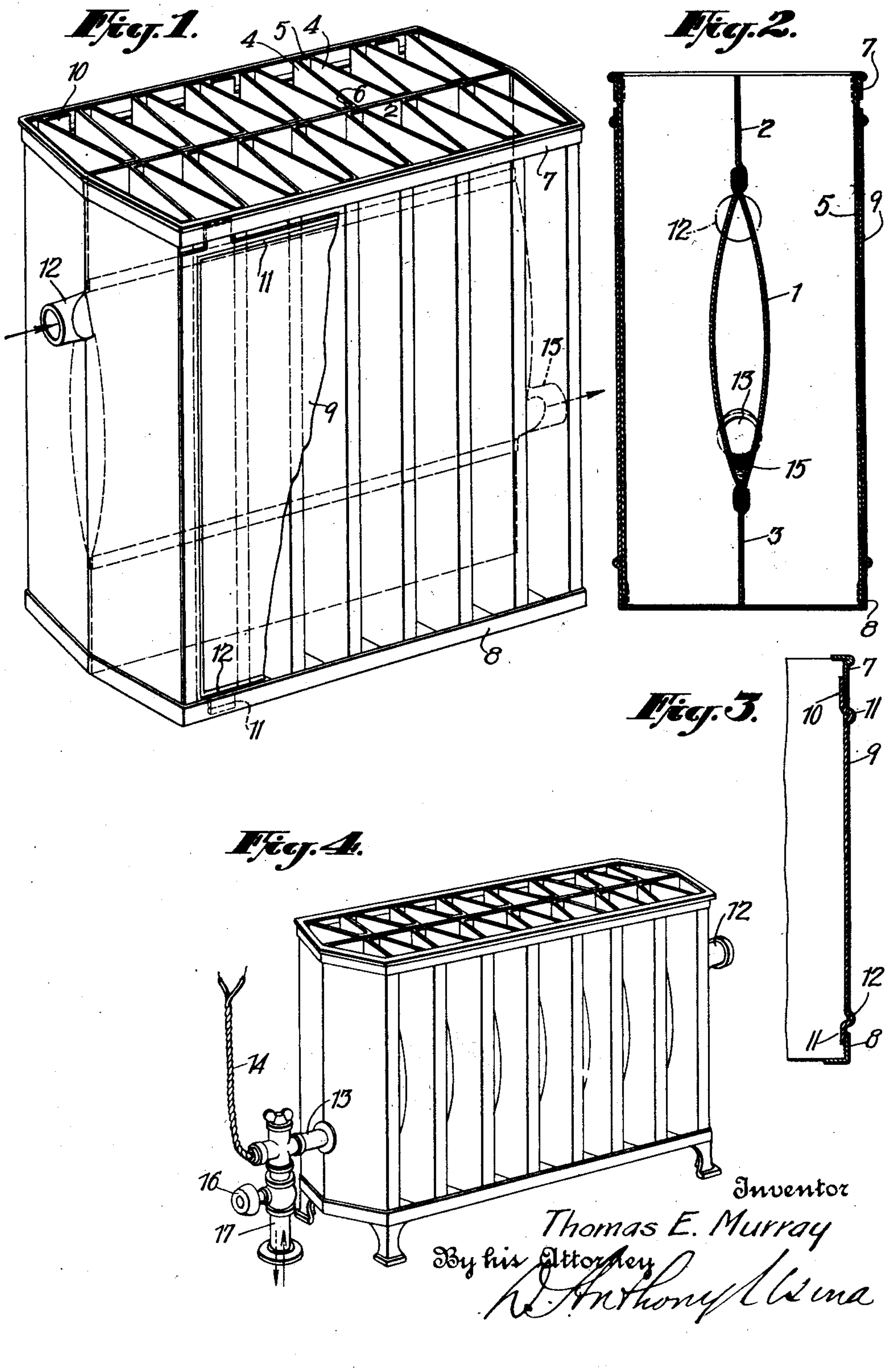
Aug. 6, 1929. T. E. MURRAY 1,723,573

RADIATOR

Filed July 14, 1925 2 Sheets-Sheet 1



Inventor

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Fig. 5.

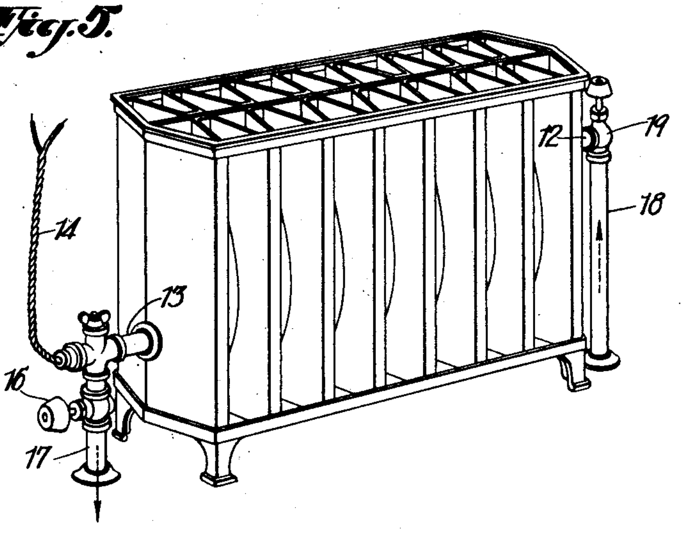
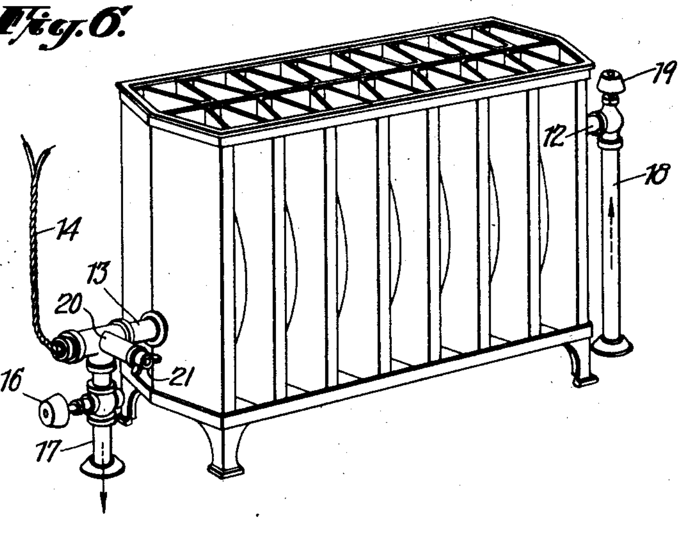


Fig. 6.



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Patented Aug. 6, 1929. **1,723,573**

UNITED STATES PATENT OFFICE.

THOMAS E. MURRAY, OF BROOKLYN, NEW YORK.

RADIATOR.

Application filed July 14, 1925. Serial No. 43,444.

My invention aims to provide certain improvements in radiators whereby a high efficiency is secured and other advantages referred to in detail hereinafter.

The accompanying drawings illustrate embodiments of the invention.

Fig. 1 is a perspective view of a radiator with part of a cover removed;

Fig. 2 is a vertical cross-section of the same;

Fig. 3 is a fragmentary cross-section in another plane;

Figs. 4, 5 and 6 are perspective views of radiators adapted to operate with different heating mediums.

Referring to Figs. 1 and 2 the receptacle or chamber for the heating medium is an approximately elliptical vessel made of two outwardly concave plates 1 crimped together at their edges, and soldered or welded if necessary to make a tight joint. Fastened to the top and bottom edges of this vessel, also by a crimped joint, are plates 2 and 3 extending above and below the vessel respectively and forming diaphragms extending the full length of the radiator. At each side of the vessel is a radiating structure comprising vertical plates 4 connected alternately at their outer and inner ends by plates 5 and 6 respectively. The latter bear against the sides 1 of the chamber and against the longitudinal diaphragms 2 and 3 and may be soldered or welded thereto to ensure intimate contact and ready transmission of heat. The upper edges of the radiating structure are surrounded by a rail or strip 7 for protection against their sharp edges and in order to stiffen them, and a similar strip 8 passes around their lower edges. The radiating structure and also the plates 1 forming the chamber and the diaphragms 2 and 3 are preferably made of copper and very thin as described in certain previous applications which I have filed. To permit the use of such thin metal stiffening means are important. This purpose is served by the corner strips 7 and 8 and particularly by the central diaphragms 2 and 3. The tying of the radiating plates to these diaphragms converts the entire radiating structure into a unit for the resistance of lateral strains from external sources and also reinforces the thin walled vessel so as to permit the carrying of a comparatively high steam pressure therein.

Each of the spaces included between a pair of plates 4 and an outer plate 5 is closed also on the inside by the diaphragms 2 and 3 and the heating vessel and forms a vertical flue through which the air will circulate rapidly in a column exposed on all four sides to contact with a direct heating or a radiating surface. By extending the radiating structure to a greater vertical length than the heating vessel, the induced draft and the rate of circulation thereof on the column of air, and the efficiency of the radiator are very considerably increased.

The space enclosed between two plates 4 and an inside connecting plate 6 serves a similar function but not so effectively because it is not closed on the outer side. I propose, however, to provide a cover which will close these spaces on the outside and thus form flues closed on all sides. Such covers are indicated at 9, consisting of plates at the opposite sides, each extending nearly the full length and height of the radiating structure. Such plates may be a permanent part of the structure, or they may be made easily removable as illustrated. The major portion of each plate 9 lies in the plane of the rails 7 and 8. It is provided, however, with ears 10 and 11 at the opposite ends which are bent in so as to lie within the rails 7 and 8. It is also formed with outwardly projecting ribs 11 and 12 which serve to stiffen it and serve also as stops to limit its vertical movement. By sliding it upward slightly from the position of Fig. 3, its lower edge can be swung outward and the plate dropped and removed.

The heating vessel has a pipe 12 at one end leading from the upper part of the vessel and a pipe 13 at the other end at a level slightly above the bottom of the chamber, leaving a small triangular space or pocket for water to accumulate.

I illustrate in Figs. 4, 5 and 6 adaptations of the radiator to various heating mediums, such as steam, electricity and hot water.

Fig. 4 is designed to be heated by either electricity or a one-pipe steam system. The electric cable 14 leads through the pipe 13 to a standard immersion electric heating element indicated diagrammatically at 15 (Fig. 2). A small body of water will generally be left in the vessel from the steam heating operations. Or water can be introduced through the pipe 12 at the opposite end by removing the cap therefrom. The application of the current very quickly converts this small quantity of water into steam sufficient to fill the chamber and produce the desired heating effect. The valve 16 is closed while heating by electric current. When steam heat is to be used the valve 16 is opened, the steam filling the vessel, and the water condensed therein flowing back through the valve 16 and pipe 17 as is common in this type of steam heating systems.

The radiator of Fig. 5 is similar to that of Fig. 4 except that it operates with a two-pipe system for the steam. A steam inlet pipe 18 is provided connecting by a valve 19 with the pipe 12 at the upper part of the heating vessel. The two valves 19 and 16 are opened to operate on steam, the condensed water running down through the pipe 17. The operation of heating with electricity is the same as in Fig. 4.

Fig. 6 illustrates an arrangement for using hot water or electricity. The connections are similar to those of Fig. 5. There is added a branch 20 on the outlet pipe 13, with a cap 21 which can be removed by hand. This cap remains in place when heating by hot water, opening the valves 19 and 16 and circulating the water as indicated by the arrows. When electricity alone is to be used the valves 16 and 19 are closed, and the cap 21 is removed to drain the water in the vessel down to the desired level after which the cap 21 is replaced.

The arrangement of Fig. 6 can be used either as a combination of electric and one-pipe steam system, by keeping the valve 19 and cap 21 shut, or as a combination electric and two-pipe steam system by always keeping the cap 21 closed. The small reservoir of water in the heating chamber may be maintained by locating the outlet pipe slightly above the bottom as illustrated or merely by draining off a portion of the water in the vessel and then closing the drain pipe whenever electricity is to be used. And this arrangement for heating by a variety of heating mediums may be applied to radiators of different designs from that shown. And other usual or suitable designs of heating element may be substituted for the vessel shown.

The radiating structures of the vessel are illustrated of such proportions as to give an unusually high ratio of total radiating surface to the volume or content of the heating chamber. For example, if the latter be of 18 by 12 by 6 inches outside dimensions, giving a capacity of something over 3 pints, or 0.056 cubic feet, the area of radiating surface, is about 24 square feet. This is a ratio of about 370 square feet of radiating surface to one cubic foot of contents of the chamber. Using copper in thin sheets, with the flue arrangement of the radiating structure extending as shown vertically beyond the chamber, the radiator is brought up to its maximum heating effect practically instantly upon the application of the heating medium.

I have found by experiment that this requires about 20 seconds with steam, and about 2 minutes (500 watts) with electricity. 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 in the vertical extension of the transverse plates above the level of the electric heating element where the heat is first applied. The transverse plates formed by the corrugated structure extend to a great height above the heating element relatively to the width of the plates so as to form heated vertical air ducts substantially unimpeded. The cool air passes and rises between the walls of the ducts formed by the plates 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 transverse plates have a close and direct contact with the sides of the vessel and they also have a good heat-conducting relation, through the sides of the vessel, with the electric heating element.

The heat produced by the electric element within the vessel is therefore transmitted to the plates forming the vertical air ducts referred to. The pairs of plates which converge at their outer edges are in fact flues closed in cross-section and adapted to produce an even greater draft upward than the spaces between such flues. That is, these flues are ducts which work even more efficiently than the open-sided ducts between adjacent flues. The result of this high vertical duct arrangement is that, instead of a relatively stationary or slowly rising and laterally diffusing overheated body of air around the heating element, and underheated air in the remainder of the room or inclosure, the present invention produces 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.

No specific claim is made herein for the electric heating element in the radiator, such claims being presented in a co-pending divisional application No. 328,675, filed December 27, 1928.

Various modifications of the apparatus shown and described 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 having a vessel for the heating medium formed of convex plates united at their upper and lower edges and a radiating structure outside of said vessel comprising vertically extending plates of greater length than the height of said vessel and engaging the convex sides of said vessel.

2. The radiator of claim 1 with a longitudinal diaphragm extending vertically beyond the vessel and engaged by said radiating structure.

3. The radiator of claim 1 having longitudinal diaphragms extending above and below said vessel and engaged at opposite sides by said radiating structure.

4. A radiator having a heating element and a radiating structure mounted at the sides thereof comprising transverse plates of greater height than said heating element connected at their edges alternately so as to form vertical flues of corresponding height so as to induce a strong upward draft and a rapid circulation of air, the alternate flues being open at the outer side, in combination with means for closing the outer sides of such alternate flues.

5. A radiator having a heating element and a radiating structure comprising vertical spaced plates at the sides thereof of greater height than said heating element and removable means for closing the spaces between the outer edges of said plates to form vertical air flues of corresponding height so as to induce a strong upward draft and a rapid circulation of air.

6. A radiator having a heating element and a radiating structure comprising vertical spaced plates at the sides thereof, rails along the edges of said plates and a cover plate adapted to be removably held by said rails to close the spaces between the outer edges of the plates and to form vertical flues.

7. A radiator having a vessel for the heating medium formed of convex plates united at their upper and lower edges and a radiating structure outside of said vessel comprising vertically extending plates engaging the convex sides of said vessel, said vessel having an outlet opening at one end above its lowest point so as to provide a pocket for a small quantity of water.

8. A radiator having a vessel for the heating medium formed of plates of thin flexible metal elongated in the horizontal direction and convex in the vertical direction and united at their longitudinal edges and a radiating structure comprising vertical plates having their inner edges united directly to the outside of said convex plates and having such width in the transverse direction as to reinforce the thin walled vessel and prevent the outward bending of the sides by the internal pressure.

In witness whereof I have hereunto signed my name.

THOMAS E. MURRAY.