Feb. 14, 1933. E. G. DOUCET 1,897,113

RADIATOR

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Fig.1

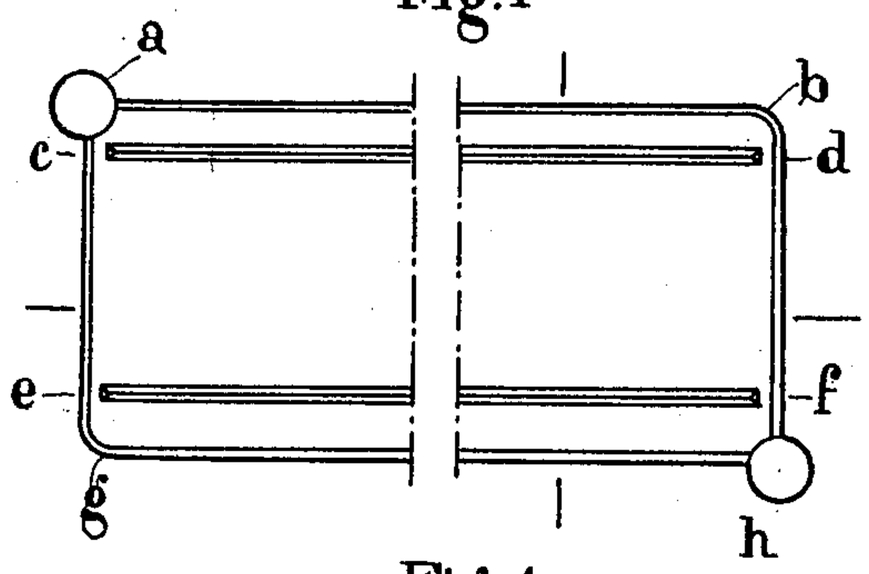


Fig.2

Fig.4

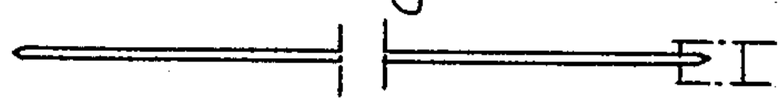


Fig.8

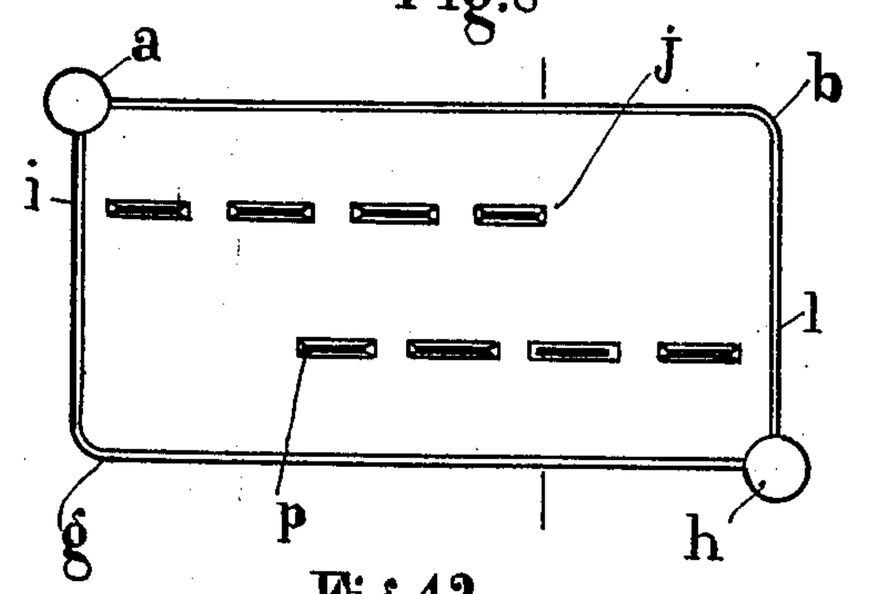


Fig.9

Fig.12

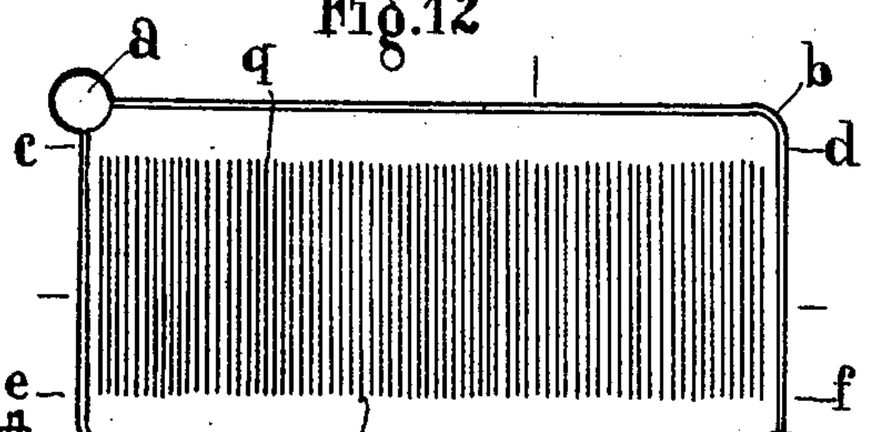


Fig.13

Fig. 18.

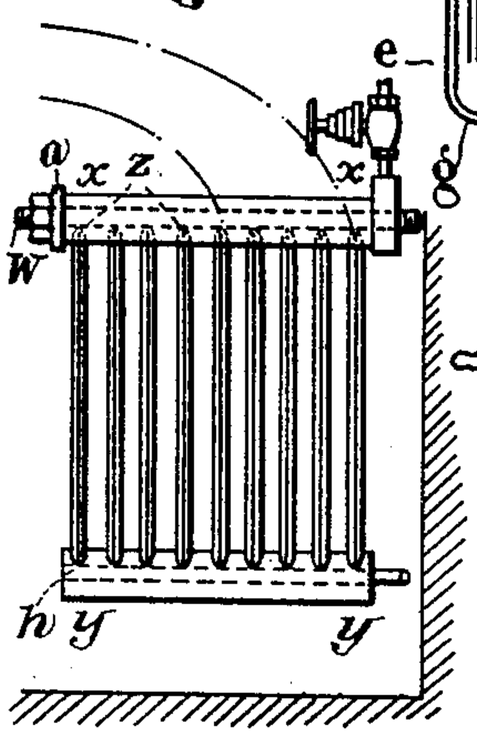
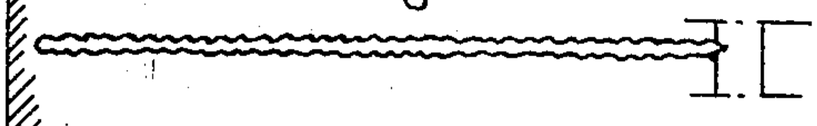


Fig.14



INVENTOR:

Edmond Gabriel Doucet

BY

ATTORNEY

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Fig.3.

Fig.5.

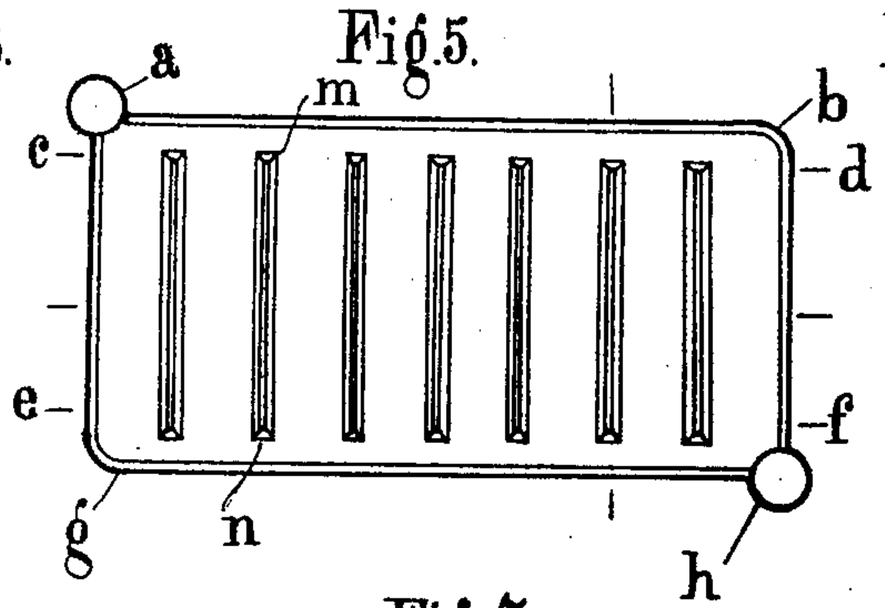


Fig.6.

Fig.7.

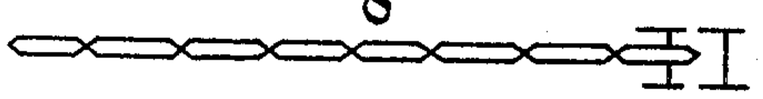


Fig.10.

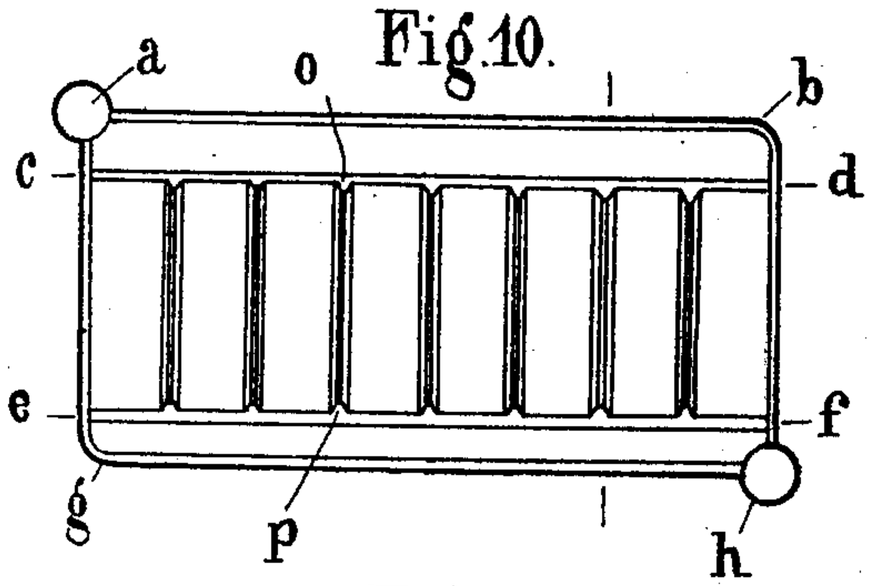


Fig.11.

Fig.15.

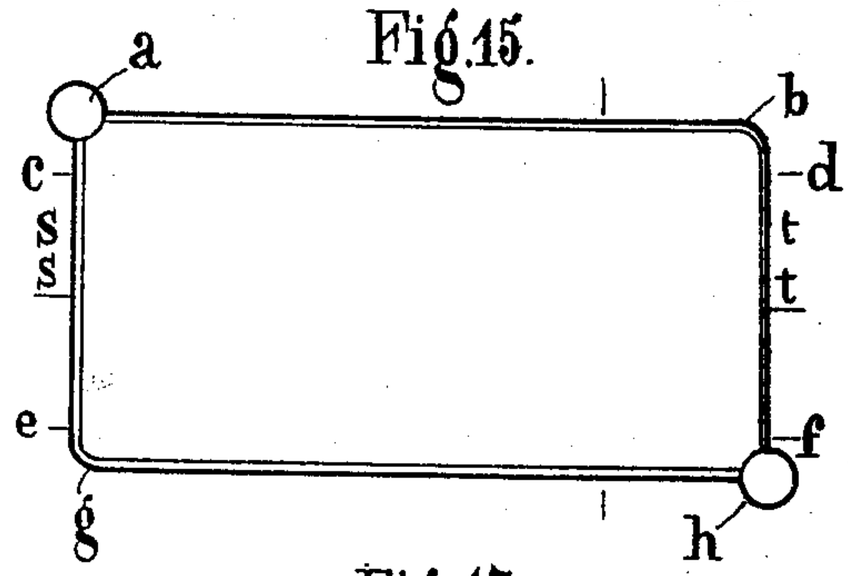
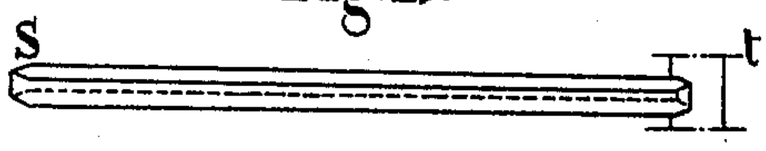


Fig.16.

Fig.17.



INVENTOR:

Edmond Gabriel Doucet

BY

ATTORNEY

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UNITED STATES PATENT OFFICE

EDMOND GABRIEL DOUCET, OF RHEIMS, FRANCE

RADIATOR

Application filed June 2, 1930, Serial No. 459,006, and in France June 6, 1929.

This invention relates to the construction of sheet metal radiators for use in central hot-water heating systems.

Such sheet metal radiators as are available now are designed on the same lines as the conventional types of grey iron radiators as regards both the individual elements and the apparatus as a whole.

As a result of this twofold observation, the technical operation is the same in both cases as far as the transmission of heat to the air and the hot water flow are concerned.

If we consider one such radiator of existing type (of sheet-metal or grey iron construction) in position against the wall of a room, it will appear as an aggregate of vertical heating surfaces arranged perpendicularly to the wall, which surfaces are connected to one another at the top and bottom thereof to form inlet and outlet manifolds which are arranged in parallel relation to the wall.

The horizontal dimension of the heating surfaces in the direction perpendicular to the inlet and outlet manifolds is generally much less than one foot.

In the sheet-metal construction of the apparatus which provides the subject matter of this invention, the standard arrangement as above referred to is reversed, that is, the vertical heating surfaces are arranged in parallel relation to the wall while the manifolds built up thereby are arranged perpendicularly to the wall.

In the embodiments which are to be described by way of example the heating surfaces consist of a pair of large-surface continuous metal sheets connected to one another so as to provide substantially flat elements through which the water is to be circulated; for the purpose of the following specification such heating surfaces will be referred to as "heating plates", which is a conventional term adopted in other arts.

In the last paragraph but one there has been pointed out that the arrangement of the heating plates in parallel relation to the wall does away with practically any limitation of their horizontal dimension.

A number of particular characteristic advantages may now be pointed out:—

The use of sheet metal as a material will allow extremely flat heating plates to be produced in practically unlimited dimensions, which gives the possibility of a lower cost of manufacture at equal heating capacities.

The use of the sheet-metal construction will allow, in order that the heat units available in the circulating water may be utilized to the best advantage, stamping operations to be used to obtain those shapes which are the most favorable to the transmission of heat, both from the water in circulation to the plate walls and from the latter to the air.

In the case of a pair of adjacent plates and as a result of their vertical arrangement and the continuousness of the individual metal sheets, a passage will be formed by said pair through which the air, by increasing temperature, will take up a vertical upward speed which may be converted into a horizontal speed by means of baffles suitably arranged on the outlet side above the apparatus.

Figure 1 represents the front elevational view of one embodiment of my heating plate.

Fig. 2 is a side view of the heating plate shown in Fig. 1.

Fig. 3 is a side view similar to Fig. 2 without the longitudinal corrugations shown in Figs. 1 and 2.

Fig. 4 is a plan view of the heating plate shown in Fig. 1.

Figs. 5, 8, 10, 12 and 15 are front elevational views similar to Fig. 1 of other embodiments of my heating plate.

Figs. 6, 9, 11, 13 and 16 are side views respectively of Figs. 5, 8, 10, 12 and 15.

Fig. 7 is a plan view of the heating plate shown in Fig. 5.

Fig. 14 is a plan view of the heating plate shown in Fig. 12.

Fig. 17 is a plan view of the heating plate shown in Fig. 15.

Fig. 18 is a side view of a complete radiator constructed in accordance with my invention in position against a wall and floor, the latter being shown in sections.

The said views 1, 5, 8, 10, 12, and 15, as shown, have the same overall dimensions; the inlets for warm water and outlets for the cooled down water are shown as similar in

construction; the same reference characters *a b*, *c d*, *e f*, *g h* are used to designate regions of similar functions (hot water inlet, main heating surface, cold water outlet) in all the figures.

The drawings are of diagrammatical character in order that the features of the invention may be more clearly pointed out as a result of an easier comparison of the six embodiments shown.

Figure 1 is a front elevational view of a heating plate characterized in that a horizontal cross section taken through any one of the three regions (*a b—c d*, *c d—e f*, *e f—g h*) is similar.

The said plate is composed of a pair of pressed metal sheets having *a—b—h—g* as their apparent contour, arranged face to face and joined to each other by any suitable method providing a water-tight joint; the sheets in the pair are so shaped that their faces are in very close relation to each other, thus providing a hollow body of very flat construction, in order that the hot water in circulation may be used under a very thin layer.

The hot water flows in at corner *a* while the cooled down water flows out at corner *h*.

Corresponding to lines *c—d*, *e—f* are ribs pressed in both metal sheets providing the heating plate; as a result of the provision of such ribs on a level with each other, the hot water which flows in at *a* is throttled at *c—d* before it enters the medial cavity *cd—ef*; likewise, the water in the medial cavity is throttled at *e—f* on flowing therefrom into the cold water outlet region *ef—gh*.

Immediately adjacent to the hot water intake *c* and the cold water outlet *h* the inward projection of the ribs is of more decided character so as to engage with each other and thus form stop partitions.

As an example of a modified construction, there may be provided a series of abutting ribs on each of lines *c—d* and *e—f*, a free passage being afforded to the water between any two consecutive pairs of ribs.

Figure 5 is a front elevational view of a heating plate characterized in that the water is guided down the medial region *c—d—e—f* by vertical pressed ribs *m—n* arranged face to face (which may or may not engage each other) and which are limited at the top and bottom ends of their length by lines *c—d* and *e—f* which have the same function as in the last mentioned embodiment.

In this modification the vertical ribs may end in short horizontal ribs between which the water may freely flow into the medial cavity.

It is to be noted that in the embodiment as shown in Fig. 5 the cross section available for the water flow is not substantially reduced in the medial portion comparatively to the upper and lower regions.

Figure 8 is a front elevational view of a heating plate characterized in that the temperature progressivity from the bottom to the top is obtained by means of horizontal baffles *i—j*, *p—l* which are assumed to be provided by companion ribs acting as stop partitions, a wide unobstructed passage being left wherever the flow is reversed. Preferably, these baffles are of sectional construction, as shown in the drawings. In this embodiment, cross sections taken anywhere but on the baffles are all similar.

Figure 10 shows by way of example a heating plate characterized in that the sheet-metal members are so formed in the medial region *c—d—f—e* thereof that their faces are in closer relation to each other than in the embodiments described hereinabove, so that the water may circulate therebetween in the form of a water film.

As a provision against possible objectionable defects, vertical ribs *o—p* protruding by an amount equal to the spacing of the walls ensure on one hand the necessary parallelism of both walls and on the other hand the maintenance of the same as a result of their being spot-welded to each other at suitable places.

Such ribs will act as guides for the vertical flow of the liquid streams.

Where such heating plates are built up into elements, plain metal sheets *u—v* are arranged between the plates whereby the enlarged passage provided between each pair of adjacent medial portions is divided into two equal passages. The said metal sheets are fitted on both faces thereof with a series of vertical ribs (or any like members adapted to secure the same result) by which the heating plates are braced to each other at their medial regions.

Figures 12 and 15 show two characteristic modifications of the preceding embodiment.

In the first modification, the narrowing of the passage all over the height of the medial region is obtained by means of pressed-out vertical corrugations *q—r*, the directing sinusoid having a very short pitch.

In the second modification, the narrowing is obtained by means of horizontal corrugations *s—t* extending all over the length and height of the medial region; here, the directing sinusoid has a very long pitch.

Figure 18 shows a lateral view of a complete radiator, that is, one built up of a plurality of heating plates assembled with one another. The view is the same regardless of the type of heating plate selected.

The drawings are completed by the indication of a floor and a wall, and also that of the air-directing baffles. In the figure, as an example of the way in which the apparatus may be mounted, the water feed valve is shown as connected either through a pipe made of cast iron or other suitable material, or directly to the duct *x—x* of relatively large

diameter which serves the twofold purpose of water circulation and unit assembly; the arrangement is the same, however without a valve, as far as the cold water offtake is concerned (pipe *y*—*y*); moreover, as shown, the pipes *x*—*x* and *y*—*y* are formed with a plurality of equally spaced rectangular openings *z* in which the corners of the heating plates are adapted to be tailed in where the same are provided with openings; it is only necessary to properly weld the joints to produce the unit given as an example in its commercial condition.

Each pipe is fitted at its end next to the wall with a suitable pipe union by which it is connected to the related main, and at the opposite end with a cap; a suitable tie-rod *w* adapted to be screwed in a tapped hole provided in a boss centrally located in the pipe union allows the direct tightening of the whole structure (pipe union, pipe, cap) by means of a nut.

It is to be understood that the heating plates shown in Figs. 1 to 18 (having a horizontal dimension which is large relatively to the vertical dimension) may be embodied along the same principles in apparatus designed on the same lines as the conventional type of cast iron radiators.

It has repeatedly been specified in the description that stamping operations are employed for the shaping of either the heating plate or the water-circulating or the air-guiding members. In fact, such manufacturing process allows very narrow passageways to be obtained practically with the necessary degree of accuracy.

As regards the butt-jointing of the heating plate halves, any method of welding will be used where the metal sheet is of suitable gauge; however, where thin sheet metal is employed, clasp-jointing will be resorted to, together with a continuous galvanizing process intended to seal up the joints.

The spot-welding process mentioned with reference to one particular embodiment however is of general character; for the sake of simplicity it has not been mentioned elsewhere, nor has it been shown anywhere.

I claim:

1. A hot water radiator, comprising an upper intake conduit for water, a lower outlet conduit for water, parallel and vertical hollow heating plates between said conduits and communicating therewith, said hollow heating plates being ribbed to provide a restricted portion for the flow of the water, sheets between the plates and parallel therewith, and means for controlling the circulation of water in the plates.

2. A radiator as set forth in claim 1, wherein the ribs are staggered horizontally.

In testimony whereof I affix my signature.

EDMOND GABRIEL DOUCET.