

May 8, 1962

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3,033,536

RADIATOR SYSTEM

Filed Aug. 27, 1959

3 Sheets-Sheet 1

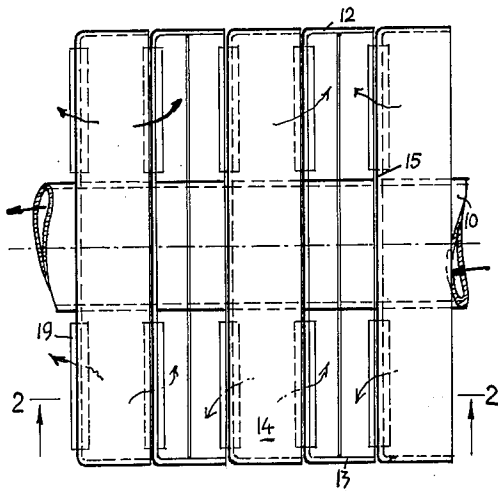


Fig. 1.

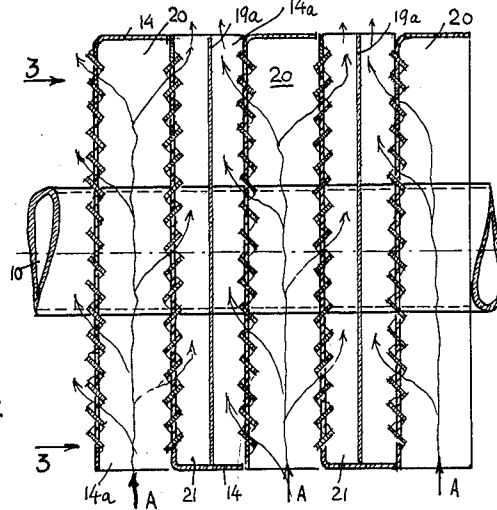


Fig. 2.

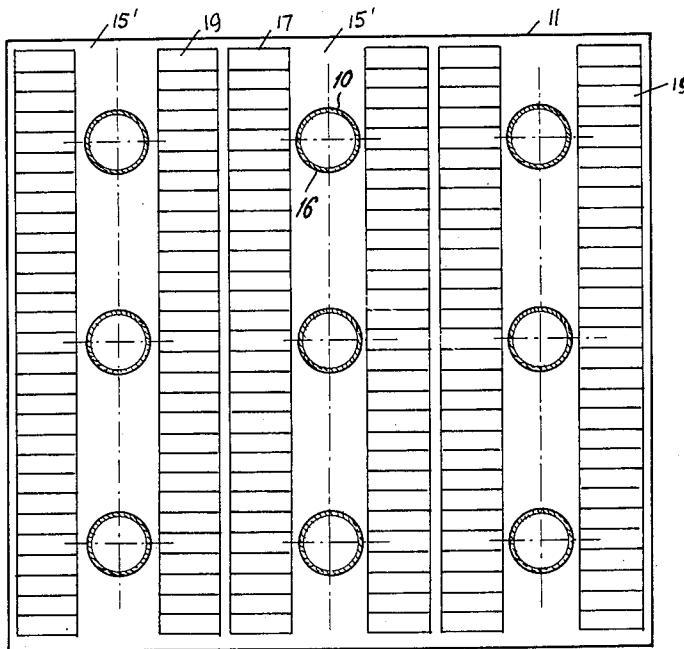


Fig. 6.

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3 Sheets-Sheet 2

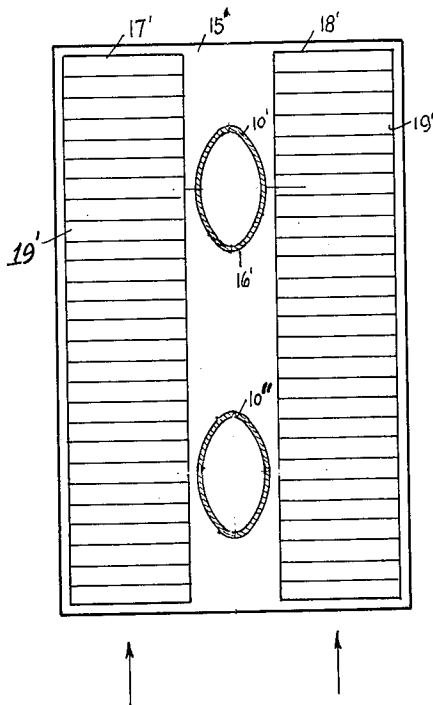


Fig. 4.

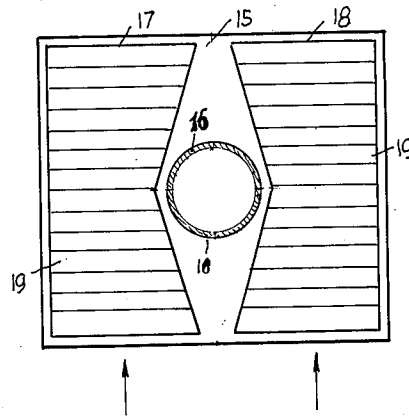


Fig. 3.

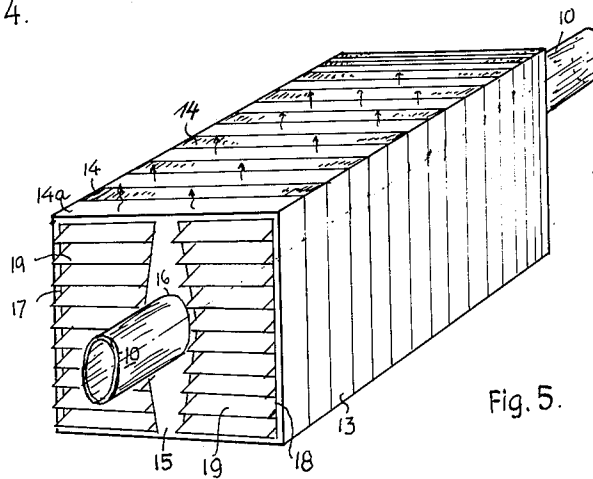


Fig. 5.

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3 Sheets-Sheet 3

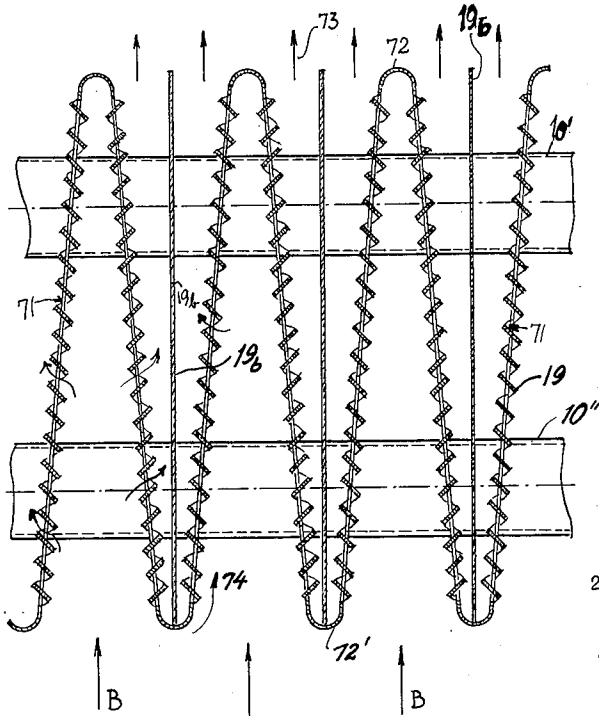


Fig. 7

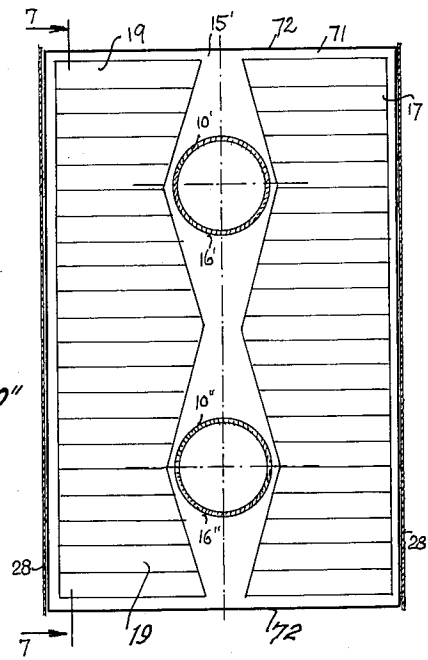


Fig. 8.

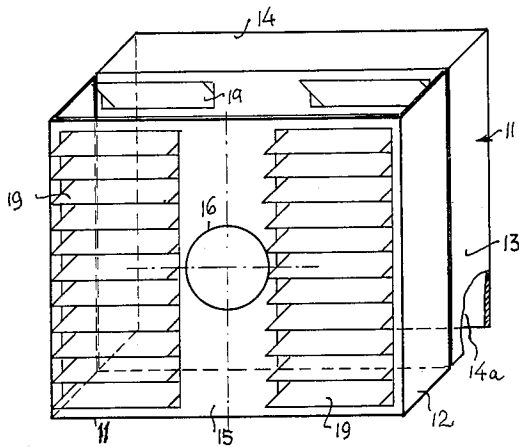


Fig. 9.

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RADIATOR SYSTEM

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5 Claims. (Cl. 257—262.16)

The present invention relates to a novel heating or cooling system.

More particularly, the present invention relates to means for heating enclosures and further for transferring heat or for directing and conveying the same out of rooms and the like.

Heaters conventionally include a pipe unit through which passes a suitable heating fluid, a plurality of fins being carried by the outer surface of the pipe. The finned pipe unit may be located in a casing which has a front wall formed with inlet openings lower than the pipe and outlet openings higher than the pipe, so that cool air flows through the inlet openings into the casing and then upwardly between the fins and around the heated pipe proper and finally flows back out through the outlet openings.

This conventional heating structure does not reach any marked output for a number of reasons. For one thing, the air forms a unidirectional stream which passes a layer of air which constitutes a substantially stationary heat insulation and which adheres to the surfaces of the fins and pipe which latter receives and conducts the heating medium.

The rest of the air is insulated from the heating structure by this layer of air and is heated by convection or indirectly via this layer. Furthermore, the air is continuously heated as it flows upwardly between the fin units, so that the temperature of the air arriving at the top portions of the fins is substantially higher than the temperature of air entering at the bottom portions of the fins, with the result that the rate of heat transfer from the fins to the air is much less at the upper fin parts than at the bottom fin parts, which fact reduces the heat economy and transfer to a marked degree.

It is therefore a primary object of the present invention to provide means contributing to a maximum of heat transfer efficiency than it was possible with conventional heater systems as discussed above and affording at a given heat output a considerable economy and cost reduction, as the heating system according to the invention is conveniently smaller in size than that heretofore required to produce the same heat output.

Another object of the invention is to provide means instrumental in constructing a heater which reliably and positively produces an air flow of far greater turbulence than can be achieved by conventional heaters, so that undesirable air cushions generally adhering to the guide plate or plates of the heater are greatly reduced.

It is also an object of the invention to provide means conducive to a heater system in which the rate of heat transfer is substantially even and uniform throughout the extent of the fin units.

A further object of the invention is to provide means rendering the possibility of a simplified heater system construction which, while accomplishing the above objects, is inexpensive to manufacture, as its components may be quickly and easily assembled in situ.

Among further important features of the invention are the provision of louvers, nozzles or like positive fluid guide and directing means forming fins, whereby the walls of three-sided containers having only one end wall are employable, which containers are disposed in a battery-like fashion of air-receiving and air-discharging chambers alternating with each other and located about and along a heat medium carrying pipe, the said louvers or like

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means directing the air from the air-receiving to the air-discharging chambers.

With the above and other objects in view, the present invention contemplates a medium transfer system having in combination, a pair of elongated parallel side wall means, at least one heating pipe extending between and spaced from the pair of side wall means, a plurality of louvered transverse walls carried by and distributed along the pipe and each extending between the pair of the wall means, a plurality of upper closure wall means, respectively, fixed to every other transverse wall and extending to the next transverse wall so as to form with the transverse walls and pair of side wall means a plurality of chambers which are open at the bottom, and a plurality of lower closure walls means, respectively, alternating with the upper closure wall means and extending between the lower ends of each adjacent pair of transverse walls which are not interconnected by the upper closure wall means so as to form a plurality of chambers open at the top, whereby air flowing into the chambers which are open at the bottom will flow through the louvered transverse walls into the chambers which are open at the top.

According to the invention, the air flow through the fins or like guide means will not be in a laminar form contrary to the conventional set up along an air cushion adhering to the respective wall, but rather in a turbulent and segregated manner. The turbulent air flow thus diminishes the insulating air cushion adhering to the fins, while the heat exchange between fins and air will be considerably increased.

By the transverse position of the upwardly inclined louvers and by the effective difference of temperature prevailing between cold and warm air, a positive flue-effect is being produced, which effect contributes also to increased heat and enhanced economical output.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a top plan view of a finned pipe unit according to the present invention;

FIG. 2 is a section taken along lines 2—2 of FIG. 1 seen in the direction of the arrows;

FIG. 3 is a sectional end view taken along lines 3—3 of FIG. 2 seen in the direction of the arrows;

FIG. 4 shows a modified structure of FIG. 3.

FIG. 5 is a perspective and somewhat schematic view of the embodiment of the present invention illustrated in FIGS. 1—3;

FIG. 6 is a view corresponding to the views illustrated in FIGS. 3 and 4 but somewhat further modified;

FIG. 7 is a sectional view taken along lines 7—7 of FIG. 8 and showing another embodiment of the present invention;

FIG. 8 shows an end view of FIG. 7; and

FIG. 9 is a perspective view of a set of fin units according to FIG. 5.

Referring now more particularly to the attached drawings, there is disclosed a finned pipe unit according to the present invention, which is adapted to be used as an air-heater and includes a pipe 10 through which a suitable heating fluid, such as hot water, is adapted to flow. The pipe 10 may be horizontally installed and supports a row of fins 11 which are all of the same construction. Each fin unit 11 is in the form of a rectangular container having three walls 12, 13, 14 and a single end wall 15. The pair of upwardly extending side walls 12 and 13 are parallel to each other and extend in the direction of air

flow. The transverse wall 14 extends between said walls 12 and 13 and across the upward direction of air flow.

As is apparent from FIGS. 1 and 2, the walls 12 to 14 determine the spacing between flat end walls 15 of the fin unit 11, the free edges of the walls 12 to 14 of each fin unit 11 contacting the end wall 15 of the next fin unit 11. The successive fin units 11 are mounted on the pipe 10 with the successive walls 14 thereof located alternately above and below the pipe 10. As a result of this arrangement one pair of adjoining fin units cooperates to form an air-receiving chamber 20 which is closed at the top by wall 14 and open at the bottom 14a while the immediately preceding or following fin units cooperate to form a pair of air-discharging chambers 21 closed at the bottom by transverse walls 14 which chambers are open at the top. Thus, the chambers 20 and 21 alternate along the pipe 10.

The flat plate portion 15 of each fin unit 11 is formed along its central axis, which extends in the direction of air flow, with an opening 16 (FIG. 3) through which the pipe 10 passes in contact with plate portion 15 to transfer heat thereto. Portions of plate 15 are fixed to pipe 10 in any suitable way, as by friction or press fit, or by being soldered or welded thereto. On opposite sides of openings 16 and symmetrically therewith the plate portion 15 is formed with a pair of cutouts or openings 17 and 18 which extend substantially from one end to the opposite end of plate portion 15 in the direction of air flow, and a plurality of louvers 19 extend horizontally across each opening or cutouts 17 and 18 and are distributed along their entire length for directing air through the cutouts 17 and 18. Thus the louvers 19 form a means for positively directing air flowing along one side of plate portion 15 through said openings 17 or 18 thereof to the other side of said plate portion.

As is apparent from FIG. 2, the louvers 19 are each in a plane forming approximately 45° with the remainder of flat plate 15. Also, as is apparent from FIG. 2, all the louvers 19 extend horizontally across cutout 17 or 18 and are inclined upwardly from air receiving chambers 20 to air-discharging chambers 21. In accordance with the invention, the fins 11, including the louvered openings, side-walls and central openings, are stamped by means of suitably shaped dies in one operation from a flat sheet of material of high thermal conductivity, such as copper or other material.

When a two-pipe fin system is used, the fins are identical with those described above, except that the flat end wall 15' will have a structure as shown in FIGS. 4 and 8. The flat plate portion 15' has a pair of openings 16' through which pipes 10', 10'' respectively pass, and these openings and pipes may be elliptical as shown in FIG. 4. The cutouts 17' and 18' of plate portion 15' are provided with louvers 19', as shown.

In the embodiment illustrated in FIG. 8, parallel vertical side wall means consisting of continuous sheets 28 and 28' replace side walls 12 and 13. Sheets 28 and 28' are not integral with the fins which in this case comprise only top walls 14, and end walls 15.

As shown in FIG. 6, multi-pipe fin systems may also be included, comprising a plurality of pipes which, for instance, may be arranged in several parallel, vertical and horizontal rows with louvered cutouts of the fins and walls 15 arranged adjacent to the individual pipes or rows of pipes.

When the finned pipe unit of the invention is installed in a casing whose front wall has inlet openings lower than and outlet openings higher than this unit, then when a heating fluid flows through pipe 10, an air circulation, as indicated by the arrows A in FIG. 2, will be generated. The air which enters the receiving chambers 20 can only flow out into the discharge chambers 21 through the louvered cutouts. The louvers 19 afford sufficiently desirable turbulence.

Also the air flows through the louvered openings along

their entire length so that the rate of heat transfer at the tops of the fins is not substantially less than the rate of heat transfer at the bottoms of the fins. Also, the air flowing out of the discharge chambers 21 creates a suction drawing air into chambers 20 and through the louvered opening into chambers 21, so that with the structure according to the invention the amount of air flowing through a heater of a given size in a preset time is greater than the amount flowing through a conventional heater of the same size in the same time, and thus, in this way also, the heat output is increased.

According to the embodiment of the present invention illustrated in FIG. 7, transverse walls 71 and upper and lower closure means 72 and 72' are integral with each other and may be formed of a continuous strip, whereby each pair of transverse walls which form a chamber 73 open at the top diverge toward the top, and each pair of transverse walls which form a chamber 74 open at the bottom diverge towards the bottom. Preferably continuous sheets 28 and 28' as illustrated in FIG. 8, are associated with the embodiment shown in FIG. 7 for forming parallel vertical side-wall means for closing the sides of the fins.

As indicated in FIGS. 2 and 7 respectively, there are provided in chambers 21 and 73 respectively, so called black bodies 19a (FIG. 2) and 19b (FIG. 7) which may be mounted on pipe 10, 10', 10'' as the case may be.

These black bodies may be in the form of plates of sheet metal such as copper or like material which are capable of receiving, storing and then releasing radiant heat emanating from the fins, including the louvers thereof.

The neutral radiation effect of the fins may be greatly reduced by the aforesaid black bodied plates which are being charged with heat from said fins and louvers. These plates thus heated up release thereafter the heat onto the air stream passing through the perforations of the fins and created by the louvers so that an enhanced heating effect is transferred onto the air streams flowing in the directions of the inflowing air according to arrows A (FIG. 2) and B (FIG. 7).

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of heaters differing from the types described above.

While the invention has been illustrated and described as embodied in an air-heater, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention, and therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. For use as a fin in an air heater, a substantially rectangular container made of a sheet material of high thermal conductivity and having only one end wall and three side walls, said end wall being formed with an opening through which a heating pipe is adapted to pass in contact with said end wall and with a pair of cutouts symmetrically arranged on opposite sides of said opening, and said end wall having a plurality of louvers extending across each cutout to direct air through each cutout from one side to the opposite side of said end wall.

2. In an air heater, in combination, a pipe through which a heating fluid is adapted to flow, said pipe extending horizontally when the heater is installed, and a plurality of

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5 fins carried by said pipe and distributed therealong, each fin being in the form of a substantially rectangular container having only one end wall and three side walls two of which are parallel to each other and extend vertically when the heater is installed and the third of which extends between the other two horizontally when the heater is installed and transversely to the upward direction of air flow produced by operation of the heater, said fins being arranged next to and in contact with each other on said pipe with said third side walls of the successive containers located alternately above and below the pipe, so that one pair of adjoining fins forms an air-receiving chamber open at the bottom and closed at the top while fins immediately preceding and immediately following said one pair of fins form therewith a pair of air-discharging chambers respectively located on opposite sides of said air-receiving chamber and each closed at the bottom and open at the top, each of said end walls being formed with at least one cutout and having a plurality of louvers extending substantially horizontally across said cutout, and all of the louvers of all of said fins being inclined upwardly from said air-receiving chambers to said air-discharging chambers.

3. In a heater, in combination, a pair of elongated parallel vertical side wall means; at least one heating pipe extending between and spaced from said pair of said wall means, a plurality of louvered transverse walls carried by and distributed along said pipe and each extending between and engaging said pair of said wall means, a plurality of upper closure wall means, respectively, fixed to every other transverse wall and extending to the next

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transverse wall so as to form with said transverse walls and pair of side wall means a plurality of chambers which are open at the bottom, and a plurality of lower closure wall means, respectively, alternating with said upper closure wall means and extending between the lower ends of each adjacent pair of transverse walls which are not interconnected by said upper closure wall means so as to form a plurality of chambers open at the top, whereby air flowing into the chambers which are open at the bottom will flow through the louvered transverse walls into the chambers which are open at the top.

4. A heater as defined in claim 3, said transverse walls and upper and lower closure wall means being integral with each other and formed by a continuous strip, each pair of transverse walls forming a chamber open at the bottom diverging toward the bottom of the respective chamber, each pair of transverse walls forming a chamber open at the top diverging toward the top thereof.

5. A heater as defined in claim 4, wherein said pair of said wall means are each in the form of a continuous sheet.

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