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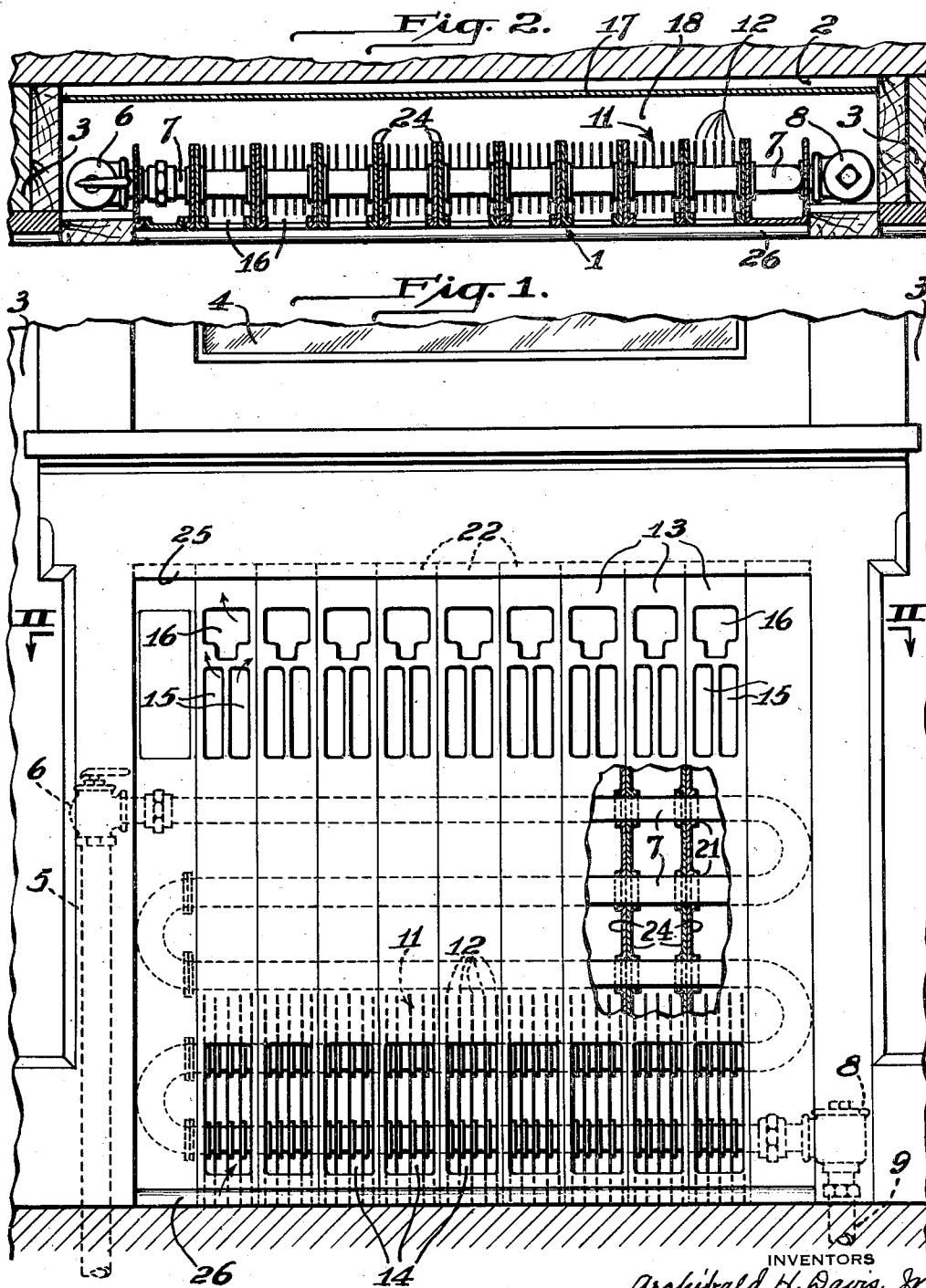
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1,998,273

RADIATOR

Filed Dec. 4, 1933

3 Sheets-Sheet 1



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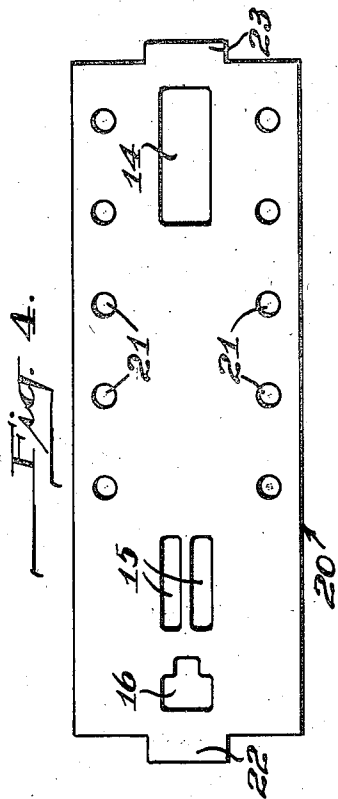
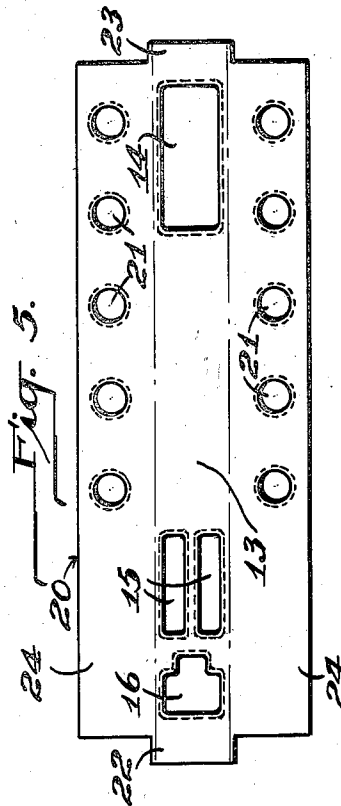
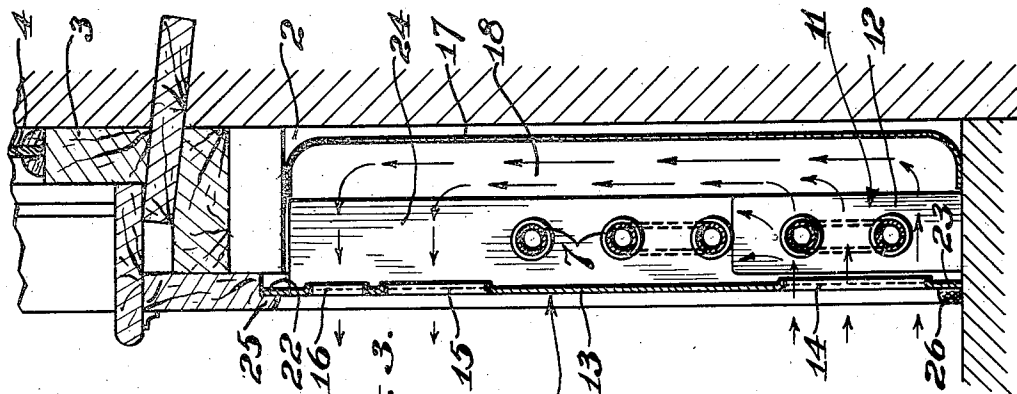
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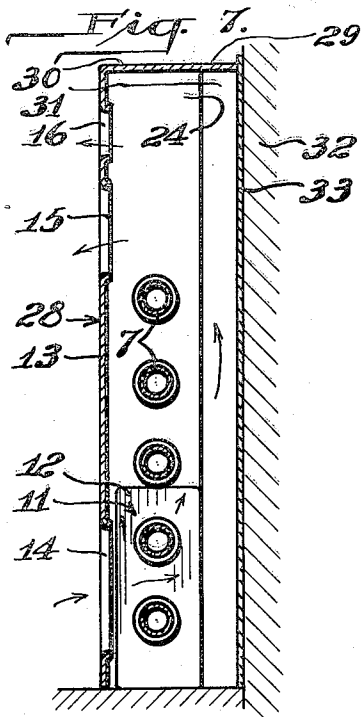
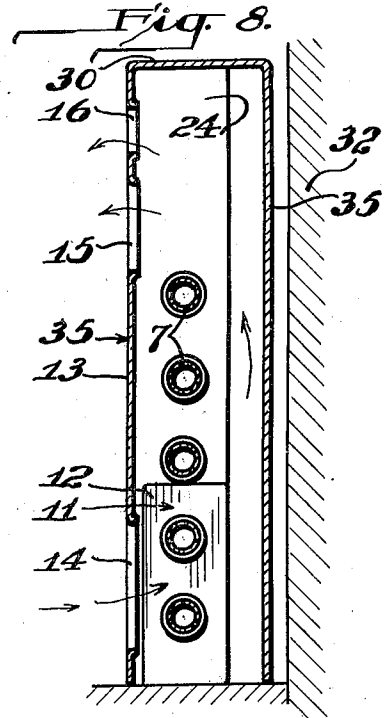
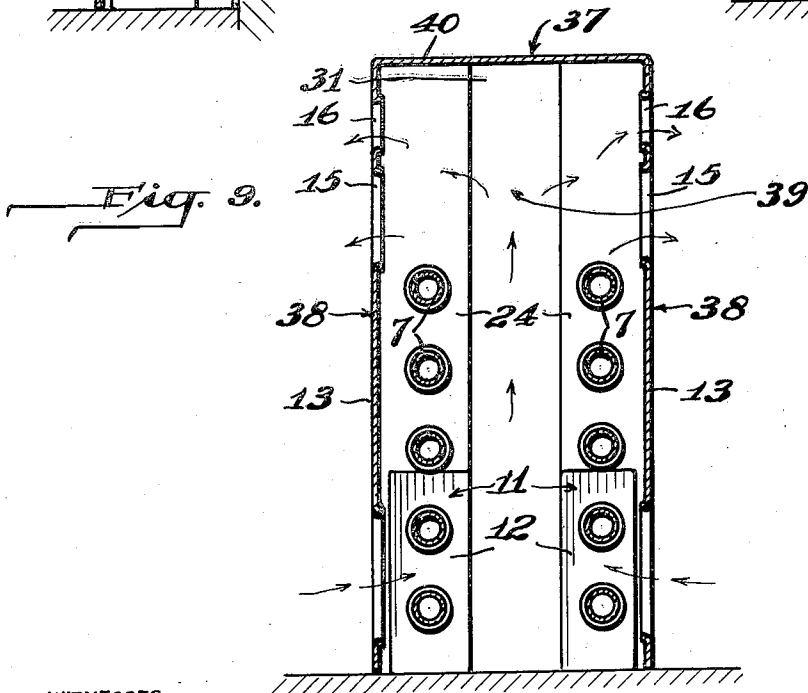
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RADIATOR

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9 Claims. (Cl. 257—136)

Our invention relates to radiators and particularly to radiators of the combined radiant and convection type.

It is an object of the present invention to provide a radiator of the type described above that is of unitary construction and that may be easily and conveniently positioned in a suitable recess or that may be partially or fully exposed to view for operation in a substantially similar manner.

Another object of our invention is to provide a radiator comprising a convection unit to which air may be admitted and delivered therefrom substantially without interference from the accumulation of such foreign materials as may come to rest upon the upper surfaces of the unit.

A further object of our invention is to provide a radiator having a convection unit of such form and arrangement that air passing therethrough may enter the unit through spaces between vertical edges of plates of the unit that are exposed to view whereby the lodging of foreign materials against the inlet face of the unit will be readily apparent and such materials may be easily removed therefrom.

In the construction and operation of radiators provided with convection units it has been the practice in a number of cases to provide a convection unit adapted to admit air into the bottom face thereof for substantially vertical flow therethrough and out at the top thereof. In such cases it will be appreciated that the accumulation of any foreign material such as plaster upon the upper surfaces or outlet surfaces of the unit will tend to restrict flow of air therethrough and that if such accumulation is allowed to continue for any considerable period of time the flow of air through the convection unit may be substantially stopped.

In accordance with our invention we provide a radiator of unitary construction and having a convection unit composed of vertically disposed plates that extend transversely to the front panels of the radiator. Suitable tubes for heating fluid, such as steam or hot water, extend horizontally through the plates of the convection unit. Other horizontal tubes, which may be in series with the first-mentioned tubes, extend adjacent to the front panels of the radiator in order that these panels may constitute a radiating section.

Air is admitted through inlet openings in the lower portion of the front panels for flow horizontally and upwardly through the convection

unit. The panels are also provided with upper or outlet openings for delivering air currents of convection to the room to be heated.

It will be understood, however, that the radiating section also heats by convection and the convection unit also heats by radiation. These parts are so named because of their primary function in the distribution of heat. In the radiator we have provided the radiating section and the convection unit are so structurally and functionally interrelated that they constitute in effect a single unit although, for convenience of description herein, they are referred to separately.

The radiator briefly described above may be mounted entirely within a recess in which case it is spaced from the back of the recess to provide in effect a flue for air currents of convection whereby the latter may travel from the convection unit upwardly and out through the outlet openings in the front panels.

In case the radiator is mounted in fully exposed position, it may be suitably enclosed in a sheet metal casing that covers the ends and top, the casing being open at the back but in engagement with the surface of the wall which may be suitably insulated. The radiator unit is spaced from the wall in order to provide the flue referred to above.

If desired, the radiator unit may have a casing that completely encloses it except for the front thereof and comprises a back suitably spaced from the front panels to provide the flue referred to above. The back of the casing may also be spaced from the wall to provide an insulating blanket of air therebetween.

The details of our invention will be described in connection with the accompanying drawings, in which Fig. 1 is a view in front elevation of a radiator of the cabinet type shown in fully recessed mounting, parts being broken away; Fig. 2 a horizontal sectional view taken on line II—II of Fig. 1; Fig. 3 a vertical sectional view of the radiator of Fig. 1; Fig. 4 a face view of a blank for forming a front panel of the radiator; Fig. 5 a view of one of the panel sections in finished form before it is folded; Fig. 6 a view of the panel section of Fig. 5 in folded position; Fig. 7 a view in vertical section of a radiator of our invention mounted in exposed position with an adjacent wall serving as back therefor; Fig. 8 a similar view of a radiator having a complete casing therefor and spaced from an adjacent wall; and Fig. 9 an end elevation of a radiator of double unit type.

Referring particularly to Figs. 1, 2 and 3, a ra-

diator 1 constructed in accordance with our invention is illustrated as mounted within a recess 2 in the wall 3 of a room to be heated. By way of example, the recess 2 is located beneath a window 4. The radiator 1 is a unitary structure provided with a smooth paneled front surface.

The radiator 1 is illustrated as provided with the usual supply pipe 5 for conveying steam through a control valve 6 to horizontally disposed heating tubes 7 arranged in a single vertical bank and connected in series. A thermostatic trap 8 at the outlet end of the heating tubes 7 connects the latter to a return pipe 9. In case hot water is used, suitable connections will, of course, be employed. Certain of the horizontal tubes 7 are preferably connected in pairs at adjacent ends thereof by suitable integral return bends, separate return bends being used at the other ends, whereby they form structurally and functionally a continuous tube from the supply pipe 5 to the return pipe 9 at the other end thereof.

At the lower end of the radiator 1 is a convection unit 11 constituted by a series of vertical metal plates or fins 12 that are mounted on the lower two tubes 7. These plates extend transversely to the front of the radiator 1 and the vertical spaces or passageways therebetween serve for the flow of air currents of convection through the unit. The separation of the exterior of the unit into inlet and outlet spaces for facilitating the flow of air therethrough will be later described.

The front of the radiator is constituted by a series of vertical panels 13 of sheet metal. Each panel 13 is provided adjacent the bottom thereof with a flanged inlet opening 14 for the admission of air horizontally therethrough into the vertical spaces between the plates 12 of the convection unit 11. The upper portion of the radiator is in the form of a grille integral with the panels thereof, the top of each panel 13 being provided with a pair of elongated openings 15 and an approximately square opening 16 for permitting the outward flow of air that has been heated principally by the convection unit 11. The openings 15 and 16 are also flanged.

As is best shown in Figs. 2 and 3, the radiator unit is spaced from a plate 17 in the back of the recess 2 in which it is mounted in order to provide in effect a flue space 18 in rear of the convection unit 11 whereby air that has been heated by the latter and other heated parts may flow upwardly and then outwardly through the outlet openings 15 and 16. The depth of the flue space need not be exact but should be such as to permit the flow of air without material resistance.

In the formation of the panels 13 sheet metal blanks 20 having the form of that shown in Fig. 4 are provided. The rectangular openings at the ends of the blanks 20 are then expanded in such manner as to provide suitable flanges on one side of the blank, thus forming the inlet opening 14 and outlet openings 15 and 16 of the panel 13. Similarly the circular holes on both sides of the blank are expanded to provide flanged holes or openings 21 through which the tubes 7 are to be threaded.

When the panels 13 are in the form illustrated in Fig. 5 they are folded into channel shape along longitudinal lines extending slightly within the edges of the end projections 22 and 23 to provide completed panels such as the panel 13 shown in Fig. 6. The panel sections 13 are then assembled by placing them side-by-side and threading the tubes 7 through the flanged

openings 21 in the rearwardly extending panel flanges 24, the ends of the tubes being connected by return bends as stated above to provide for continuous flow of heating fluid therethrough.

The plates 12 of the convection unit 11 are placed on the lower pipes 7 in proper sequence with each other and with the flanges 24 at the same time that the tubes 7 are threaded through the lower openings 21 in the flanges 24 of the panel sections 13. If desired the tubes 7 may be expanded by hydraulic pressure after they are in position in the holes 21 and through the plates 12 in order that there may be such firm engagement between the tubes 7 and the surrounding flanged edges as to readily effect exchange of heat therebetween and to lock all parts rigidly together.

In mounting the radiator 1 in position in the recess 2, the end projections 22 and 23 of the panels 13 bear against the upper and lower outer edges respectively of the recess 2. The upper and lower edges of the radiator 1 may be covered with suitable molding strips 25 and 26 as best shown in Fig. 3.

When the radiator is assembled as set forth above, the continuous tube formed by the connected tubes 7 constitutes a mechanical support for the panels 13 and the plates 12 and ties the entire structure together. This continuous tube supplies heat for both the radiating and convection portions.

The flanges 24, which extend in pairs between groups of the plates 12 and the rear vertical edges of which are flush with those of the plates, are of relatively heavy sheet metal and of such rigidity as to protect the edges of the relatively thin metal plates particularly in shipping and erecting the radiators. The flanges 24 serve as convection members and also conduct heat to the front surfaces of the panels 13.

The arrangement of the plates 12 of the convection unit 11 entirely within the flanges 24 of the panels 13 provides that the flanges act as flues to increase the upward flow of air above the convection unit. A greater flow of air with a corresponding increase in heat exchange occurs in this arrangement with plates or fins of relatively short vertical length than would be the case if the plates were relatively long by reason of the increased air resistance of the longer plates.

In the operation of the radiator shown in Figs. 1, 2 and 3 steam or other suitable heating fluid is admitted through the control valve 6 for flow through the continuous passageway formed by the several tubes 7 in series. The plates 12 of the convection unit 11 are heated as are the flanges 24 and the front portion of each of the panels 13. The heating of the latter causes them to radiate heat outwardly into the room.

The heating of the air between the plates 12 causes the air thus heated to flow upwardly and rearwardly into the flue space 18 defined by the back plate 17 of the recess and the front portions of the several panels 13. Air flows horizontally through the openings 14 into the vertical spaces between the plates 12. The air currents of convection thus formed pass upwardly in the flue space 18 and flow outwardly through the upper openings 15 and 16 into the room to be heated.

As is best shown in Fig. 3, the upper portion of the front side of the convection unit is sealed from the inlet openings 14 by the flanges surrounding the openings 14. Such small amount

of air as may flow upwardly around the flanges will be heated by the overlapping portions of the panels 13 and plates 12. This arrangement serves two very useful purposes, one being that air is prevented from flowing diagonally across a very small portion of the upper front corner of the unit into the flue space 18 without being adequately heated, as would occur if the entire front face of the unit were open to the inflow of air without any separation from the outlet spaces at the upper end of the convection unit. Another useful purpose is served by this arrangement in that air from the inlets 14 may flow vertically through the upper part of the convection unit and out of the top thereof while permitting a normal rate of flow horizontally through the remainder of the unit. The capacity of the convection unit and accordingly of the radiator is correspondingly increased.

It will be appreciated that if desired the upper end of the unit may be sealed instead of the front upper portion and "short-circuiting" of the air will be prevented. However, in such case the flow of air through the unit will be substantially entirely horizontal and the increased capacity of the preferred arrangement will be sacrificed.

The lower portion of the convection unit must also be sealed to prevent "short-circuiting" of cold air. The lower front side of the unit 11 may be sealed by the flanges of the air inlet openings 14 or, as is preferable, the unit may rest directly on the floor and the provision of any other sealing means for the bottom of the unit is not necessary.

It will be noted that in order to prevent "short-circuiting" of cold air, it is necessary to seal the inlet space from the outlet space. The sealed portions must have a width substantially equal to the horizontal width of the plates in order to insure that all air passing through the unit traverses a distance at least approximately equal to the width of the plates in order to be adequately heated. This provision also equalizes the flow through various portions of the unit because of the substantially uniform distance between the various portions of the inlet space and the nearest outlet space.

Reference may now be had to Fig. 7 in which a radiator unit 28 similar to that of Figs. 1, 2 and 3 is mounted in exposed position. The front portion of the radiator 28 is similar in all respects to that of the radiator described above. A casing 29 consisting of a top 30 and two similar side members 31 (only one of which appears) encloses the space between the panels 13 of the front of the radiator and the wall 32 in rear thereof which may be, if desired, provided with a suitable heat-insulating plate 33. The operation of the radiator 28 is similar in all essential respects to that of the radiator 1 described above.

In case it is desired to space the entire radiator unit from the wall it may be mounted in a manner shown in Fig. 8. The casing 29 is now provided with a back 35 which may be either integral with the top and end portions or may be separate, as desired. The operation of this form of our invention is similar in all respects to that of Fig. 7.

In each of the arrangements shown in Figs. 7 and 8, the outlet openings for the air currents of convection may, if desired, be provided in the top of the casing.

Reference may now be had to Fig. 9 in which is illustrated a radiator 37 which consists of two

similar main units 38 each of which is similar in construction and operation to the radiator 1 of Figs. 1, 2 and 3. Parts that are duplicates of those of Figs. 1, 2 and 3 are designated by like reference numerals.

The main units comprising front radiant panel portions 13 having inwardly extending flanges 24 are placed back-to-back and spaced to provide a flue 39 therebetween. Thus each unit 38 constitutes a back for the flue space of the other unit. The radiator units 38 may be provided with a top 40 if the panels 13 are provided as shown with outlet openings 15 and 16. If desired, however, the top of the radiator 37 may be partially or wholly open in which case the outlet openings 15 and 16 may be omitted.

In the operation of the radiator 37 of the double unit type, air enters through the inlet openings 14 on each side and flows through the convection units 11 horizontally and upwardly and into the flue space 39 between the units. Heated air flows into the room either through the outlet openings, if provided, or out of the top.

This form of radiator is particularly adapted for locations requiring radiators of large capacity such, for example, as public buildings or rooms with large floor spaces.

A radiator constructed in accordance with our invention is very efficient by reason of the increased capacity of the convection unit as arranged therein. The radiator occupies relatively small space but provides a relatively large total surface area for the exchange of heat with the adjacent air. All visible portions of the radiator including the panels, as well as the plates 12, radiate heat directly into the room and adjacent and substantially parallel to the floor of the latter where heating is ordinarily most desirable.

In addition air is admitted horizontally to the heated plates of the convection unit for passage either horizontally or upwardly therethrough into a flue space for the air currents of convection. The air inlets of the radiator are in full view and readily accessible whereby any obstruction as by lint or other material may be readily detected and removed and the free flow of air through the convection unit may thus be assured.

Also, it will be appreciated that in case foreign material, such as plaster or other material, accumulates on the top of the convection unit 11, it will not prevent the flow of air through the latter because it may find an outlet at the rear of the convection unit regardless of the restriction of flow through the top of the unit.

The mounting of the convection unit in a vertical position and sealed as described above permits the radiator to be mounted in a recess flush with the front wall of the room regardless of excessive depth of the recess as the width of the flue in rear of the panels is not material so long as it is ample. The draft created by such flue increases the amount of air passing through the radiator.

Since air is admitted only at inlet spaces of the convection unit that are suitably sealed from the outlet spaces thereof, the flow of air through the unit is assured inasmuch as cold air can not by-pass the unit. Also, the air must travel a predetermined distance through the unit.

Also the vertical spacing of the tubes extending through the convection unit increases the free air space or cross-sectional area of the path of air through the unit and the latter offers less resistance to the flow of air therethrough than would be the case if the tubes were spaced

horizontally for upward flow therebetween. The length of the total clearance space between the tubes and adjacent walls is greater than if the unit is placed across the flue space for upward flow only therethrough.

The construction of the radiator whereby it may rest directly on the floor is of advantage because the appearance of the radiator is greatly improved over that of one spaced therefrom because it appears to be an integral part of the structure of the room. In addition, the floor serves as a closure for the bottom portion of the radiator to limit the inward flow of air to the inlet openings in the front thereof.

The edges of the closely spaced convection plates ¹² so divide the large spaces provided by the inlet openings in the front panels as to present an attractive appearance.

The foregoing and other advantages will be apparent to those skilled in the art of constructing radiators.

We claim:

1. A radiator comprising a front panel for heating by radiation, a convection unit connected to said panel for heating air currents by convection, and tubes for heating fluid extending through said convection unit and adjacent said panel, said radiator having bottom and top openings for respectively admitting air laterally to said convection unit and delivering air currents of convection to the room to be heated.

2. A radiator comprising a front panel for heating by radiation, a convection unit connected to said panel for heating air currents by convection, said convection unit comprising a plurality of vertically disposed plates extending transversely to said panel, and a series of horizontal tubes extending adjacent to said panel and certain of which extend through said plates, said panel being provided with a bottom opening for admitting air horizontally into the vertical spaces between said plates, and said panel having upper openings for delivering air currents of convection to the room to be heated.

3. A radiator comprising sections each of a single piece of sheet metal constituting front panels having inwardly bent flanges with tube-receiving openings, tubes for heating fluid disposed through said openings for holding said panels in alignment, and a series of plates vertically disposed and arranged side-by-side on a plurality of said tubes adjacent the bottom portion of said radiator, said front panels being provided with lower openings for the admission of air horizontally therethrough between the front portions of said plates and provided also with upper openings for the delivery of air currents of convection into the room.

4. A radiator comprising sections each of a single piece of sheet metal constituting front panels having inwardly bent flanges with tube-receiving openings, a plurality of vertically spaced horizontally extending tubes for heating fluid extending through said openings for holding said

panels in alignment, and a series of horizontally spaced vertically disposed plates on certain of the lower tubes, said front panels having upper and lower openings for respectively admitting air adjacent the front edge portions of said plates for travel therebetween and delivering air currents of convection into the room to be heated.

5. A radiator comprising a front panel, a convection unit having a series of horizontally spaced vertical plates adjacent to said panel, means in rear of said panel for defining a flue for air currents of convection from said unit, and means comprising a portion of said panel for directing the flow of air horizontally between said plates on one side thereof and out of unobstructed vertical spaces on another side thereof, whereby the depth of said flue may be greater than the horizontal width of said plates.

6. A radiator comprising a front panel composed of a series of vertically interlocking sheet metal units, a convection unit comprising a plurality of horizontally spaced vertical plates extending transversely to said panel, a portion of one vertical side of said unit being open to the atmosphere and said panel overlapping another portion of said side to obstruct the flow of air thereinto, and a heating tube for connecting said panel and said plates and for heating them.

7. A radiator comprising a front radiant panel composed of a series of vertically interlocking sheet metal units, a convection unit comprising a plurality of horizontally spaced vertical plates extending transversely to said panel and partially overlapping the latter to provide open and obstructed portions of said unit on one side thereof, and said unit being adapted to rest upon the floor to obstruct another side thereof, and a heating tube for mechanically connecting said panel and said plates.

8. A radiator comprising two spaced units in symmetrical relation, each unit comprising a front radiant portion having an inlet opening, and a plurality of vertical convection plates across said opening and extending transversely to said front portion to provide spaces for the flow of air inwardly therethrough to the space between said units which constitutes a flue therefor, and means for heating said units.

9. A radiator comprising two units that are placed back-to-back and spaced to provide a flue space therebetween, each of said units comprising a front radiant panel portion having a bottom inlet and having a plurality of rearwardly extending flanges, a series of vertical convection plates extending transversely to said front panel portion and across said inlet to provide spaces for the flow of air therethrough into said flue space, and means comprising a tube extending through said plates and said flanges for heating said unit.

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