Jan. 27, 1931. J. R. COE 1,790,535

RADIATOR

Filed Sept. 22, 1927 2 Sheets-Sheet 1

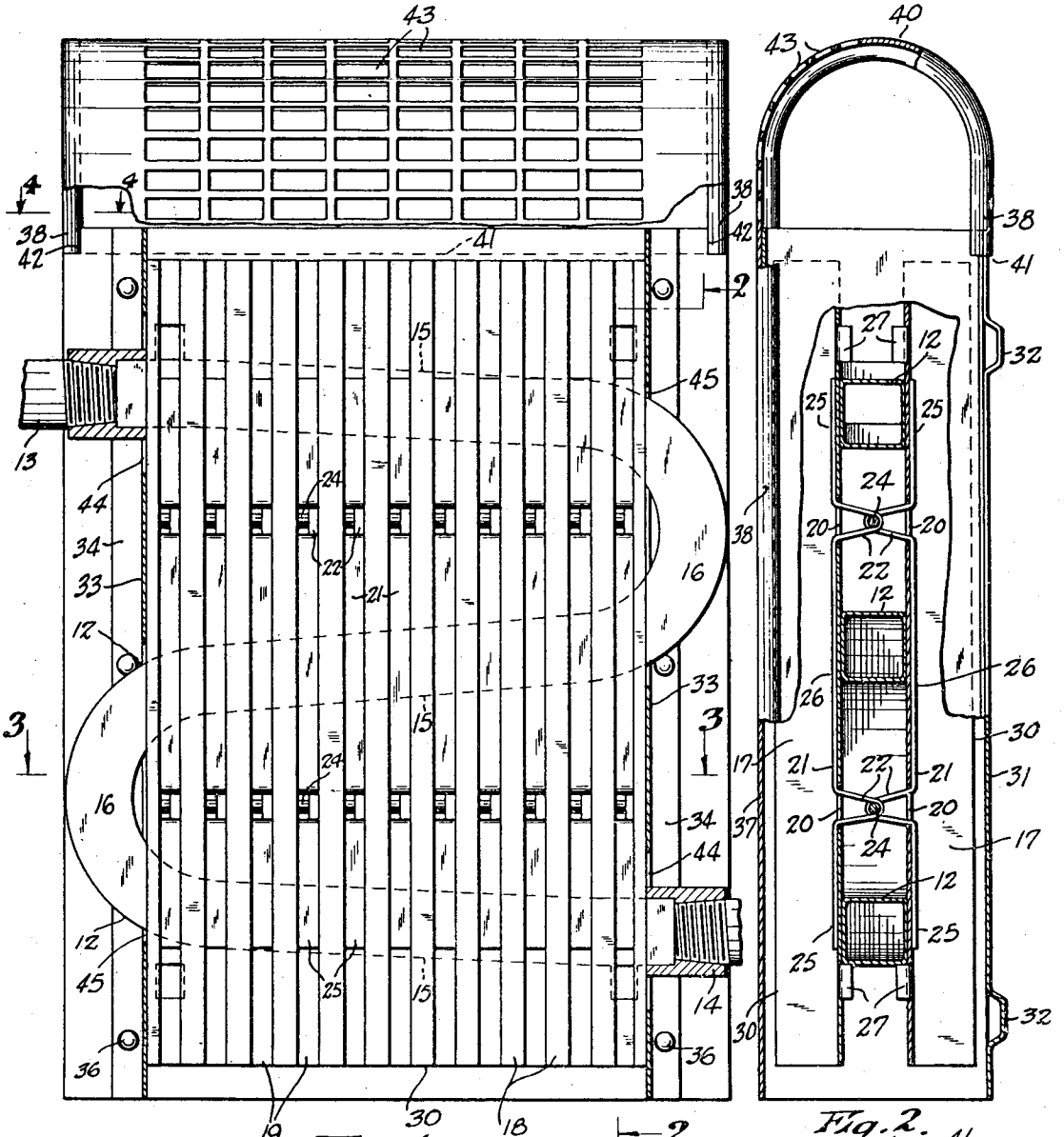



Fig. 1.




Fig. 2.

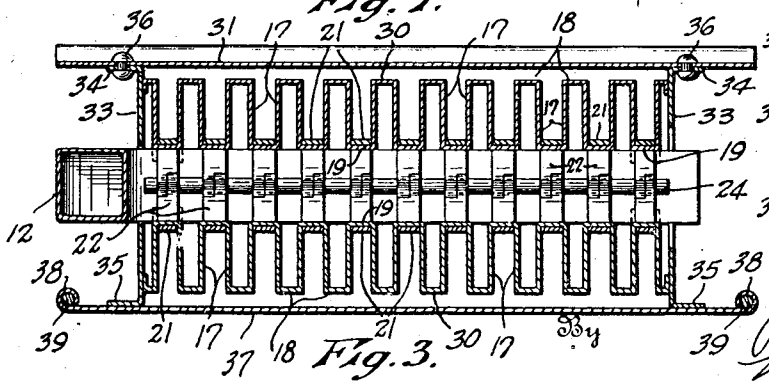



Fig. 3.

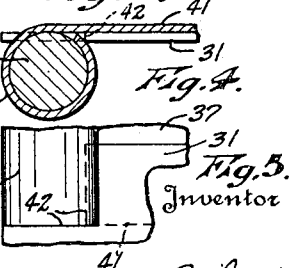



Fig. 4.

Fig. 5.

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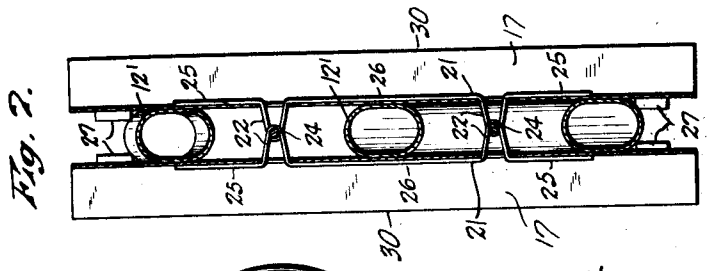


Fig. 2.

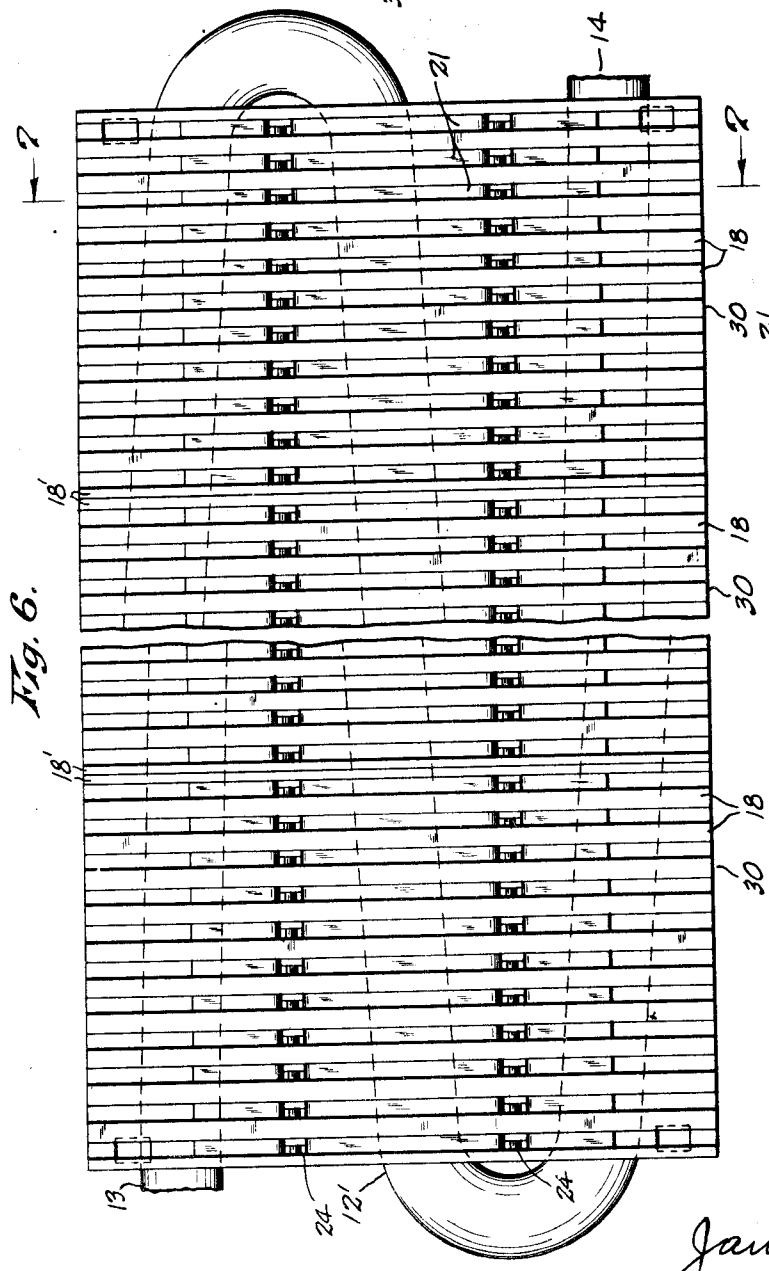


Fig. 6.



Fig. 8.



Fig. 9.

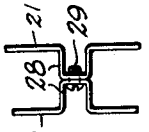


Fig. 10.

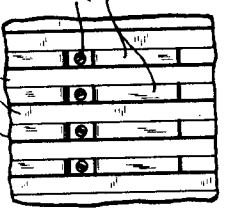


Fig. 11.

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# UNITED STATES PATENT OFFICE

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## RADIATOR

Application filed September 22, 1927. Serial No. 221,303.

This invention relates to heating radiators and has for a particular object to provide a radiator which will have a large heating area as compared with the space required for the radiator so that it is especially adapted for use in apartments and other locations where the available space is limited.

It is also an object of the invention to provide a radiator which is extremely simple in construction so as to facilitate manufacture and assembly.

It is a further object of the invention to provide a radiator construction in which it is not necessary to provide a separate set of tools for manufacturing different sizes of radiators, different sizes being provided by merely using pipes of different lengths as required and forming the air heating elements in sections, and in using the same sections for all lengths of radiator, merely using the required number of sections to give the required length of radiator.

It is a still further object of the invention to provide a radiator structure in which no soldering operations are required to attach the air heating elements to the pipes, to thus secure a greater heating efficiency and to allow for free expansion and contraction to correspond with the changes of temperature.

With the foregoing and other objects in view, I have devised the construction illustrated in the accompanying drawings forming a part of this specification. In these drawings,

Fig. 1 is a front elevation of a radiator involving my invention, a portion of the front wall of the casing being removed to more clearly show the construction.

Fig. 2 is a partial end elevation and partial vertical section thereof, the section being substantially on line 2—2 of Fig. 1.

Fig. 3 is a horizontal section substantially on line 3—3 of Fig. 1.

Fig. 4 is a detail section through one corner of the casing at the upper part thereof, substantially on line 4—4 of Fig. 1.

Fig. 5 is a detail elevation looking from the bottom of Fig. 4.

Fig. 6 is a front elevation of a radiator with its casing removed showing how the radiating fin sections are applied to form radiators of different lengths.

Fig. 7 is a vertical section substantially on line 7—7 of Fig. 6.

Fig. 8 is a side elevation of the preferred form of clamp for clamping the radiating fins to the sides of the pipe.

Fig. 9 is a front elevation thereof.

Fig. 10 is a detail elevation showing a slightly different form of clamp, and

Fig. 11 is a detailed side elevation of a small portion of a radiator showing the clamp of Fig. 10 in use.

This radiator is intended ordinarily to be constructed of copper although, of course, it is not limited to this particular metal, but as copper is expensive it is desirable to secure the maximum heating effect with a minimum of material, and as copper is a very efficient conductor of heat a comparatively large heating effect can be secured from a radiator that requires a comparatively small space as compared with cast iron and similar radiators. It has been common practice to form these copper radiators with steam pipes to the sides of which have been soldered air heating fins for increasing the air heating surface of the radiator. These soldered connections are objectionable as being expensive to properly produce, they cut down the efficiency of the radiator because the solder is a relatively poor conductor of heat, and due to the uneven expansion and contraction of the elements used to produce the radiator they are very apt to soon break loose, still further reducing the efficiency of the radiator. To overcome these objections I have produced an improved and simplified construction using air heating plates or fins which may be easily and quickly manufactured, and have produced improved means for clamping these heating elements to the steam pipes without the use of solder and in such a way that there will be a maximum transfer of heat from the pipes to these elements, and at the same time they may have relative movement to allow for expansion and contraction without injury to the elements. Still further the clamping means are so constructed that the air heating

fins may be quickly and easily applied to the pipes.

In this type of radiator it is preferred to make the steam pipe as a continuous element of a generally zigzag shape and in an upright plane so that the portions of the zigzag extend longitudinally of the radiator and are inclined sufficiently to permit the water of condensation to drain out of the pipe, but it will, of course, be understood that other types of steam pipes may be used if desired. Referring to Figs. 1 to 5 this zigzag pipe is shown at 12, and to secure the greatest heating effect the opposite side walls should be substantially flat. The pipe may, therefore, be either square or rectangular in cross section, as shown in Fig. 2, or these flat sides may be produced by rolling a round pipe to flatten the opposite sides thereof, as shown in Fig. 7. These flattened side walls increase the contact surface between the pipe and the air heating fins as will more fully appear later. As shown in Fig. 1 the pipe 12 has the usual inlet connection 13 and the outlet 14 at its lower end, and these may be controlled by the usual valves, not shown. It will also be apparent that the pipe is arranged in the upright plane with the sections 15 of the zigzag arranged one above the other and connected by curved portions 16.

On opposite sides of this pipe or conductor for heating fluid are air heating elements. In the form shown these elements comprise spaced upright laterally extending plates 17. These plates are made from a single sheet of metal formed to substantially the shape in cross section shown in Fig. 3. It will be apparent from this figure that the sheet is really given a general zigzag shape forming the plates 17 substantially parallel and with the alternate pairs connected at their outer and inner edges respectively by flat strips 18 and 19. It will be obvious this structure gives an extended heating surface for the air which passes up between the plates, and as these plates are ordinarily made of sheet copper which is a very good conductor of heat, this radiator has an extended and effective surface for heating the air. In order, however, that these plates or fins should be properly heated for heating the air they must be so connected to the pipe 12 for the heating fluid that heat will be readily and efficiently transferred from this pipe or conductor to these plates. A construction which has been hitherto employed involves the soldering of heating plates to the sides of the pipe. This arrangement is objectionable as being expensive, and is inefficient because the soldered joint is a relatively poor conductor of heat, the solder being a poor conductor as compared with copper. Also, due to the uneven expansion and contraction, these joints soon break loose still further reducing the heat conductivity of the joint.

I overcome these objections by providing an improved clamp which will firmly clamp the heating plates against the opposite flat sides of the pipe and give a very close contact between the plates and the pipe without the use of solder. The inner strips 19 of the air heating plates are provided with vertically spaced openings 20, and in the channel formed by the two plates connected to this strip is placed a clamp 21. This clamp may be of various shapes but is preferably substantially that shown. It comprises a piece of flat metal of the proper length offset at two or more points to give the substantially U-shaped loops 22. These loops are passed through the openings 20 in the strips 19 of the heating plates and are of such a length that the loops from two opposed clamps overlap as shown in Figs. 2 and 3. It is also preferred to facilitate this overlapping by cutting off substantially half of the inner ends of the loops, as indicated at 23. These loops are made of such a length that when they overlap they form a space for the entrance of a securing or locking rod 24 with the opposed loops passing around opposite sides of this rod, and thus it locks the two clamps together. This same pin may be used to lock together a whole series of these clamps as indicated in Fig. 3. The loops are made of proper length so that after the pin is inserted the clamps are under sufficient tension to firmly clamp the strips 19 tightly against the outer flat side surfaces of the conductor or pipe 12. The portions 25 at the free ends of the clamps and the body portion 26 between the loops are curved or bowed substantially as shown in Fig. 8, to secure a greater spring clamping effect after the loops are locked together. As these clamps are made of resilient or spring metal they not only firmly clamp the heating elements against the steam pipe so as to give a close contact between them to cause an efficient transfer of heat from the pipe to the elements, but they also permit relative movement between the pipes and the heating element to allow for expansion and contraction incident to the different temperatures involved. Still further it will be apparent that the insertion of a single rod 24 will automatically clamp an extended strip of heating element to the pipe, greatly facilitating the assembly of this structure and reducing the cost. As the heating elements are merely clamped against the sides of the pipe the variations in dimensions incident to manufacture do not interfere with the proper assembly of the structure, and it permits the shaping of the steam pipe 12 so that the connecting portions 15 may be inclined as desired to give the proper drainage for the water of condensation. It is preferred to strike out ears 27 adjacent the corners of the heating element as a sort of positioning

means to properly locate the heating element with respect to the pipes.

Other means may be used for securing the opposed clamps together as for instance that shown in Figs. 10 and 11, in which the ends of the loops 28 may be connected by a screw 29. This is not as desirable as the first form, however, because a separate screw must be used for each pair of loops, thus greatly extending the time required for assembly of the radiator over that of the first form where all of the loops of a row may be secured by a single pin.

The individual air heating elements 30 comprising the plates 17 and strips 18 and 19 are made of a length to correspond with the shortest length of a radiator to be manfactured, there being one of these elements on each side of the pipe 12 in the short radiator as shown in Figs. 1 and 3. In making longer radiators, however, they are designed to be of a length which is a multiple of the shortest radiator so that for these longer radiators we merely use two or more of these sections of heating elements to clamp on the opposite sides of the steam pipe. This is shown in Fig. 6 where the steam pipe is indicated at 12′ and the heating elements, which are exactly the same as that shown in Figs. 1 to 3, are clamped on the opposite sides of this pipe in exactly the same manner as that shown in Figs. 1 to 3. The steam pipe is made of a length to correspond with the desired length of radiator and the required number of heating elements 30 are clamped on the opposite sides thereof edge to edge. The outer strips at the edges of the elements are made of half the normal width as indicated at 18′ so that when two of them are placed together they will give a strip of the normal width and thus give a uniform appearance to the radiator.

The completed radiator also includes an enclosing casing preferably of sheet metal. The casing is removed in Figs. 6 to 7 to more clearly disclose the structure of the heating elements proper, but it will be of the same construction as that in Figs. 1 to 3 except that it will be of greater length. This casing comprises a rear wall 31, and preferably has transverse ribs or lugs 32 to space the casing from the wall. It is preferably somewhat longer than the vertical height of the heating elements so that they will be completely enclosed by the casing, and secured to this rear wall are the upright end walls 33 having at their vertical edges lateral flanges 34 and 35, the flanges 34 being secured to the rear wall by any suitable means such as rivets 36. The casing is completed by a removable front wall 37 which rests against the front flanges 35 of the end walls but is not secured to them. Its opposite upright edges are rolled into beads 38 around a strengthening wire 39, and at its upper portion this plate is curved back over the top of the heating elements, as shown at 40 in Figs. 1 and 2, with its rear edge 41 extending back of and overlapping a portion of the upper end of the rear wall 31. At its opposite ends this rear wall is notched, as shown at 42, so that the bead 38 will seat in these notches and rest on the bottoms thereof. Thus the front wall cannot move forwardly as it is held by the overlapping relation with the rear wall, and cannot slide longitudinally because it is held by beads 38 in the notches 42. It may, however, be easily removed by lifting it from the other walls to give easy access to the heating elements for cleaning, inspection or repair. The front part of the curved top 40 is provided with exit openings 43 for the heated air after passing over the heating elements. It is preferred that only the forward portion of this curved top be perforated so as to direct the heated air laterally into the room and thus keep it away from the walls, curtains or other articles which might be suspended above the radiator. It will, of course, be understood that the device is supported a suitable distance above the floor so that the air may enter the lower open end of the casing and pass up about the heating elements. It will also, of course, be understood the end walls 33 may be provided with suitable openings 44 for the ends of the pipes and openings 45 for the curved portions 16 of the pipe.

Having thus set forth the nature of my invention, what I claim is:

1. In a radiator, a conductor for heating fluid, a series of upright spaced metal fins engaging the opposite sides of the conductor and means separate from said fins for yieldingly clamping said fins against the conductor so as to allow for expansion and contraction while the fins are held in contact with the conductor.

2. In a radiator, a conductor for heating fluid, a series of upright laterally spaced metal plates engaging a side wall of said conductor, and means separate from said plates for yieldingly clamping said plates against said side wall so as to allow for expansion and contraction while maintaining the plates in contact with the conductor.

3. In a heating radiator, a conductor for heating fluid including longitudinally extending vertically spaced pipes, a series of upright spaced metal fins engaging the opposite sides of said pipes, and means separate from said fins for yieldingly clamping said fins against the pipes so as to allow for expansion and contraction while maintaining the fins in contact with the pipes.

4. In a heating radiator, a conductor for heating fluid having flat side walls, a series of upright laterally extending metal plates forming upright passages for air and engaging said flat surfaces so that they are heated

thereby, and means separate from the plates for yieldingly clamping said plates against the said side walls so as to allow for expansion and contraction while the plates are held in contact with the conductor.

5. In a radiator, a conductor for heating fluid comprising portions arranged in spaced relation one above the other and having substantially flat side walls, sheet metal air heating means comprising connected upright spaced plates engaging a side of said conductor, said plates being of a length to bridge the spaces between said spaced portions of the conductor, and means for clamping said plates against the side of the conductor.

6. In a radiator, a conductor for heating fluid comprising portions of pipe arranged in spaced relation one above the other, air heating means at the side of said conductor comprising spaced, laterally extending upright plates, the alternate pairs of plates being connected at their inner edges and the adjacent plates of adjacent pairs being connected at their outer edges, and means for clamping said inner connections against a side wall of the conductor.

7. In a radiator, a conductor for heating fluid comprising portions of pipe arranged in spaced relation one above the other, an air heating element at the side of the conductor comprising a continuous sheet of metal formed into spaced upright laterally extending plates with each plate connected at its outer and inner edges to the adjacent plates on opposite sides thereof respectively by substantially flat strips, and spring clamps engaging the inner of said strips to clamp them against the side of the conductor.

8. In a radiator, a conductor for heating fluid comprising portions of pipe arranged in spaced relation one above the other, air heating means at the opposite sides of said conductor comprising laterally extending spaced upright plates with the alternate pairs connected together at their inner edges by a substantially flat strip; and means for clamping said strips against the opposite sides of the pipe portions comprising resilient clamping members engaging the strips on their outer surfaces and having offsets passing inwardly through openings in said strips, and means for securing together the offsets of opposed clamping members.

9. In a radiator, a conductor for heating fluid comprising portions of pipe arranged in spaced relation one above the other, air heating means on the opposite sides of said conductor comprising upright spaced laterally extending metal plates having lateral strips at their inner edges, and means for clamping said strips against opposite sides of said conductor comprising resilient clamps engaging said strips and having offsets extending through the strips, the offsets of opposed clamps being overlapped at their inner ends, and a rod extending through the overlapped portions to secure them together.

10. In a radiator, a conductor for heating fluid comprising portions of pipe arranged in spaced relation one above the other, air heating means on opposite sides of said conductor comprising a metal sheet formed into upright spaced plates with the alternate pairs connected at their outer and inner edges respectively by flat strips with the inner strips having vertically spaced openings, and resilient upright clamps engaging the outer surfaces of the inner strips and having offset loops extending inwardly through said openings, the loops of opposed clamps having their inner ends overlapped, and a rod extending through the overlapped ends of the loops to lock them together.

11. In a radiator, a zigzag pipe having flat side walls arranged in an upright plane with the portions of the pipe arranged one above the other, air heating means comprising spaced upright plates on opposite sides of the pipe having laterally extending strips at their inner edges engaging the sides of the pipe, and resilient means engaging said strips to yieldingly clamp them against the sides of the pipe and hold them in contact with the pipe during expansion and contraction.

12. In a radiator, a zigzag pipe having flat side walls arranged in an upright plane with the portions of the pipe arranged one above the other, air heating means comprising spaced upright plates on opposite sides of the pipe having laterally extending strips at their inner edges engaging the sides of the pipe and provided with vertically spaced openings; resilient clamps having offset loops extending inwardly through said openings, the inner ends of opposed loops being in overlapped relation, and a rod extending through said loops to lock them together and clamp the plates against the pipe.

13. In a radiator, a zigzag pipe having flat side walls arranged in an upright plane with the portions of the pipe arranged one above the other, air heating means at the opposite sides of the pipe comprising a metal sheet of zigzag shape with the bodies of the zigzags upright and the inner connecting strips engaging the sides of the pipe, and resilient means for yieldingly clamping the said connecting strips against the pipe.

14. In a radiator, a heating element comprising a conductor for heating fluid and upright air heating plates yieldingly clamped to said conductor, a sheet metal casing enclosing said heating element having an air inlet at the bottom and an outlet at the top, said casing being provided with means to engage and support the heating element in fixed relation to the walls of the casing so as to give similar air conducting spaces on both sides of the element and thus guide the

air through the radiator in such a manner that all portions of the air conveyed is subjected to practically equal heat treatment.

15. In a radiator, a conductor for heating fluid comprising portions of pipe arranged in spaced relation one above the other, upright air heating plates secured to said conductor, a sheet metal casing comprising an upright rear wall, and end walls secured thereto, and a front wall extending between the front edges of the end walls and curved rearwardly over the radiator at its upper end and resting on the top of the rear wall, the front part of said curved top of the front wall being provided with air outlet openings.

16. In a radiator, a conductor for heating fluid arranged in an upright plane, air heating means associated with said conductor, a casing including an upright rear wall and end walls secured thereto, the rear wall having notches in its upper edge at its opposite ends, a front plate having its opposite upright edges rolled into strengthening ribs, said front plate being curved rearwardly over the radiator at the top with said ribs seated in the notches, the front portion of said curved top being provided with air outlet openings.

17. In a heating radiator, conducting means for heating fluid including longitudinally extending tubular portions arranged one above the other in spaced relation, air heating means including upright laterally spaced metal plates engaging the opposite sides of said tubular portions, said plates being of a length to bridge the space between said tubular portions, means for clamping the plates to said portions including clamping elements engaging the plates on opposite sides of the conducting means, and means for securing opposite clamping elements together.

18. In a radiator, a conductor for heating fluid, a series of upright spaced metal fins having spaced portions engaging the opposite sides of the conductor and means for yieldingly clamping said engaging spaced portions of said fins against the conductor so as to allow for unrestricted expansion and contraction of the unengaged portions of said fins while the fins are held in contact with the conductor.

19. In a radiator, a conductor for heating fluid, a series of upright laterally spaced metal plates having spaced portions engaging a side wall of said conductor and means for yieldingly clamping said engaging spaced portions of said plates against said side wall so as to allow for unrestricted expansion and contraction of the unengaged portions of said plates while maintaining the plates in contact with the conductor.

20. In a heating radiator, a conductor for heating fluid including longitudinally extending spaced pipes, a series of upright spaced metal fins having spaced portions engaging the opposite sides of said pipes, and means for yieldingly clamping said engaging spaced portions of said fins against the pipes so as to allow for unrestricted expansion and contraction of the unengaged portions of said fins while maintaining the fins in contact with the pipes.

21. In a heating radiator, a conductor for heating fluid having flat side walls, a series of upright laterally extending metal plates forming upright passages for air and having spaced portions engaging said flat surfaces so that the plates are heated thereby and means for yieldingly clamping said spaced engaging portions against the side walls so as to allow for unrestricted expansion and contraction of the unengaged portions of said plates while the plates are held in contact with the conductor.

In testimony whereof I affix my signature.

JAMES R. COE.