June 13, 1933. A. H. DAVIS, JR., ET AL 1,914,200

RADIATOR

Filed Sept. 11, 1931

Fig. 1.

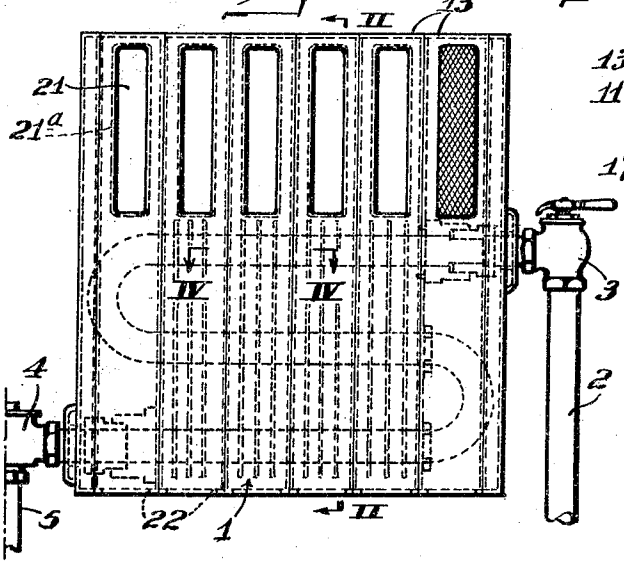


Fig. 2.

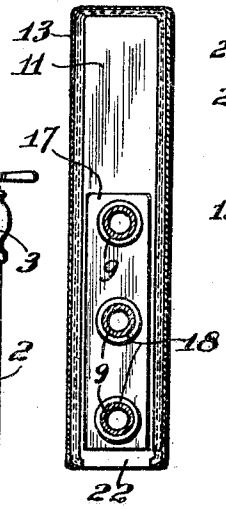


Fig. 3.



Fig. 4.

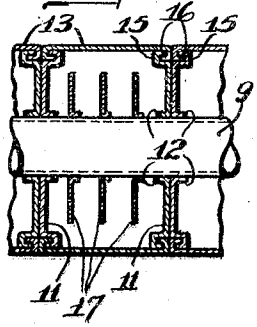


Fig. 6.

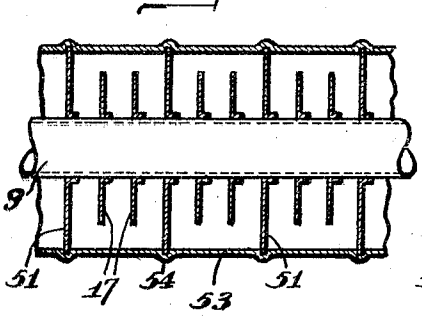


Fig. 5.

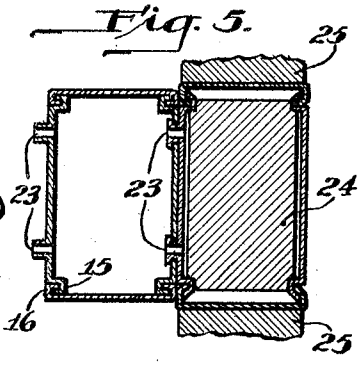


Fig. 7.

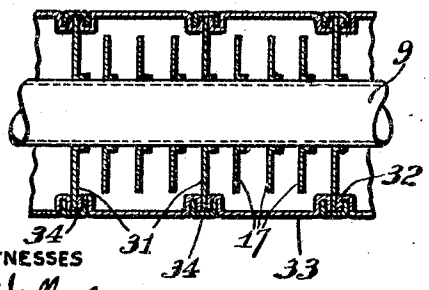
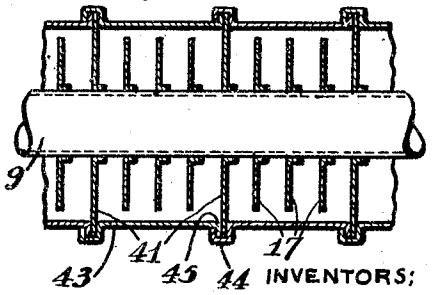


Fig. 8.



WITNESSES

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UNITED STATES PATENT OFFICE

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RADIATOR

Application filed September 11, 1931. Serial No. 562,309.

This invention relates generally to radiators.

It is an object of the invention to provide a radiator in which a tubular primary heating element and a sheet metal extended-surface structure are fastened together to constitute a unitary cabinet and heat-transferring apparatus. Another object is to provide a unitary radiator and cabinet structure, the exterior of which is formed by strips of metal each of which extends continuously up the front, across the top, and down the back of the radiator.

In accordance with this invention we provide a radiator comprising a heating element, preferably a tube for conveying heated fluid, and a plurality of transverse plates or partitions disposed on the tubes. The spaces between adjacent partitions are closed at their sides by strips or ribbons of sheet metal that extend up the front, across the top, and down the back of the radiator, leaving the bottom open to admit air, suitable openings being provided at or near the top to permit egress of heated air. The ribbon is secured at its edges to the edges of the adjacent transverse plates preferably by folded joints.

The stated objects of the invention, together with other objects that will become apparent upon further consideration of this specification, may be attained by means of the particular apparatus described herein and shown in the accompanying drawing, in which

Fig. 1 is a view in front elevation of an extended-surface radiator embodying our invention;

Fig. 2 is a sectional view of the radiator taken on the line II—II of Fig. 1;

Fig. 3 is a perspective view of one of the ribbons that constitute the exterior of the radiator;

Fig. 4 is a view in horizontal section of a portion of the radiator taken on the line IV—IV of Fig. 1 showing the internal construction thereof;

Fig. 5 is a view, similar to Fig. 4, showing the manner in which the joints between the ribbons and transverse plates are closed;

Fig. 6 is a view in horizontal section of a portion of a radiator that embodies a modification of our invention;

Fig. 7 is a view similar to Fig. 6 showing another modification of the invention; and

Fig. 8 is a view similar to Fig. 6 showing a further modification of the invention.

Referring more particularly to the drawing, the structure shown in Fig. 1 constitues a unitary, self-contained, heat-transferring apparatus and cabinet that may be supported on the floor of a room by means of a suitable base or legs (not shown), mounted on a wall by brackets or secured in any other convenient position in any suitable manner.

The radiator presents a smooth exterior divided into panels or sections, each composed of a shell 1. For purposes of illustration, the radiator is shown connected at one end to the usual supply pipe 2 by means of a control valve 3, and at the other end a trap 4 is shown for conveying liquid from the radiator to a return pipe 5.

Heating medium from the pipe 2 passes through the radiator by means of a plurality of horizontally disposed tubes 9, the runs of which are connected at their ends to constitute a continuous passageway from the control valve 3 to the trap 4, as shown in dotted lines in Fig. 1. The tubes 9 are disposed one above the other, preferably in the vertical mid-plane of the radiator, and are held in position by transverse plates 11, forming partitions, provided with spaced openings for receiving each of the tubes.

As shown in Fig. 4 the transverse plates 11 constitute partitions that separate adjacent sections 1 and constitute each section an independent flue for promoting an upward convection current of air. In this particular modification of the invention each partition is made up of two plates 11 in juxtaposition with flanges 12 at each opening extending in opposite directions from the plane of the partition.

The exterior of each section or panel 1, is formed from a single continuous strip or ribbon 13 of sheet metal that extends up the front, across the top and down the back of

the radiator. As shown the ribbon begins and ends at the bottom of the radiator, but it may be made to begin and end at any convenient point of the sides or top of the radiator.

The edges of the ribbon 13 are connected to the edges of the partition plates 11 preferably by means of folded joints. As shown in Figs. 4 and 5 the outer edges of the two plates 11 that make up each partition are so bent that they extend towards each other to form hooks 15 that together constitute channels at the edges of the partitions similar in shape to T slots. Likewise, the edges of the ribbons 13 are bent back upon the main portion thereof to constitute hooks or flanges 16 that may be fitted into the T slots at the edge of the plates 11 and disposed in hooked engagement with the hooks 15 on the edges of the two plates 11 that constitute the sides of each of the sections.

The plates 11 are joined to the tubes 9 and the ribbons 13 by heat-transferring joints in such manner that heat is transmitted from the tubes through the plates to the ribbons, which thus constitute a radiant exterior wall for radiating heat into the room. This outer wall furnishes a safe surface where the heating medium is low-pressure steam or hot water, since the heat of the tube 9 is reduced by the time it reaches the outer surface of the cabinet to a point where it is not dangerous to touch.

In addition to transmitting heat directly to the room from the radiant exterior of the sections, the air within each section is warmed by heat from the plates 11 and the inner surface of the ribbon 13 as well as from the tubes 9. The plates and ribbons thus constitute extended surfaces or secondary heating surfaces operating in conjunction with the surface of the tube 9, which is the prime heating surface.

To provide additional surface for heating the air within the radiator, a plurality of intermediate free fins 17 may be mounted within each section. As may be seen in Fig. 2, the intermediate fins 17 are each provided with spaced openings 18, similar to the opening 12 in the partitions 11 for receiving the tubes 9. The intermediate fins 17 may be of any length or shape desired. As shown in Fig. 2 they extend only a short distance above the uppermost tube 9.

To assist in inducing convection currents, and to provide space for the outlet openings each section extends for an appreciable distance above the upper tube 9 and is provided in its forward side with an outlet opening 21 having its bottom edge above the tops of the fins 17. These openings are bounded by inturned rounded flanges 21a, which strengthen the walls at the openings and improve the appearance. The heated air which is expelled through the outlet opening 21 is replaced by air from the room which enters the radiator through inlet openings 22 provided at the bottom of each section.

In manufacturing a radiator in accordance with this invention, the various plates and ribbons are cut from flat sheet material, preferably sheet steel, and pressed or folded to their final shapes. The pairs of plates 11 which make up a partition as shown in Fig. 4 are then placed together and may be secured to each other by suitable fastening means such as punched and interlocked eyelets 23 (Fig. 5), or the tubes may be depended upon to hold them togther without other fastening means.

The partitions 11 may then be disposed in spaced relation, and the ribbons 13 slipped over them from the top with the flanges 16 at the edge thereof in engagement with the hooks 15 at the outer edge of the plates 11. After the ribbons 13 are thus placed in position, the joints between the fins 11 and the ribbons 13 may be tightened by pressing them between an internal die 24 and exterior dies 25 as shown in Fig. 5.

The intermediate fins 17 may then be placed within the sections suitably supported in their proper positions, after which the tubes 9 may be passed through the aligned openings 12 and 18. Usually the upper and middle tube runs 9 are formed in one piece suitably bent upon itself, in such manner that the runs may be inserted through the sections together. The lower tube 9 may then be placed in position and connected to the middle tube by a suitable return bend 26 fastened to the tube ends by brazed joints 14 or other suitable connecting means.

To lock the entire structure together to form a unitary piece of apparatus, the tube 9 may be expanded to grip the inner surfaces of the openings 12 and 18, in the plates and fins, respectively, by subjecting the tube to high internal pressure. The heat-transferring ability of the various joints may, if desired, be increased by uniting them by a soldering, tinning, or galvanizing process, or in some instances it may be desirable to connect the parts by a soldering or similar process without expanding the tube 9.

In the modification of the invention shown in Fig. 7 the partitions between the sections are formed by single plates 31 carried on tubes 9 passing through flanged openings in the plates. The ribbons 33 that constitute the exterior of this radiator are provided at their edges with reversed curved flanges 32 which extend inwardly from the plane of the ribbons and then are bent outwardly to bring them parallel with the partitions 31 and with their edges substantially even with the outer edges of the partitions, which, in this modification, are formed plain without flanges or hooks.

Separate clamping strips 34 of U-shaped

cross section are provided to clamp the edges of two adjacent ribbons tightly against the sides of transverse plate 31. The clamping strips 34 extend continuously up one side of the radiator over the top and down the other side in a manner similar to the ribbons 33. The intermediate plates 17 may be provided within each section.

The modification of this invention which is shown in Fig. 8 is quite similar to that shown in Fig. 7, with the exception that separate clamping strips are not used in this construction. As shown, partitions or transverse plates 41 are carried on the tubes 9 by means of flanged openings thereon and are left plain at their outer edges. Each of the ribbons 43, which constitute the exterior of the radiator, is provided at one edge with an outwardly bent flange 44 that is disposed parallel to the partition 41 with its edge substantially even with the edge of the partition. The other edge of each ribbon 43 is provided with a hook or reverse curve flange 45 that extends outwardly parallel to the plate 41 and is then bent around the end of plate 41 and the end of the flange 44 on the adjacent ribbon 43 and brought inwardly parallel to the plate 41 in such manner that it clamps the flange 44 tightly against the plate 41.

In Fig. 6 is shown a further modification of the invention in which substantially the entire outer surface of the radiator is formed from a single sheet or ribbon 53 of metal. As in the structures of Figs. 7 and 8, the interior of the radiator is divided into sections by transverse plates 51 extending at right angles to the tubes 9 and having plain outer edges. The one piece shell or ribbon 53 is divided into panels by outwardly pressed ribs 54, disposed to provide grooves or channels in the inner surface thereof for receiving the outer edges of the plates 51.

As shown, the grooves engage the plates 51 in much the same manner that the hooked flanges 45 of Fig. 8 engage the plates 41. The grooves are made originally somewhat narrower than the plates 51 and the shell 53 may be pressed into position. If desired, additional fastening means may be provided as by soldering or spot welding the ribs 53 to the edges of the plates 51.

It will be apparent to those skilled in the art, to which this invention relates, that various modifications may be made in the structures illustrated, as for instance in the particular joints or fastening means between the parts that make up the radiator, without departing from the spirit and scope of the invention defined in the appended claims.

We claim:

1. Heat-exchanging apparatus comprising tubes for conveying a heating medium, extended-surface plates carried by the tubes, and continuous strips of metal attached to the edges of the plates, each strip constituting a front and a back panel of a cabinet containing the apparatus.

2. A radiator comprising a horizontal tube, vertical parallel plates carried by the tube constituting extended heating surfaces, and a continuous ribbon of metal attached to the edges of adjacent plates and constituting unitary front and back walls of the radiator.

3. A radiator comprising horizontal tubes, vertical parallel plates carried by the tubes constituting extended heating surfaces, and a continuous ribbon of metal attached to the edges of the plates and extending up the front, across the top, and down the back, with openings near the top and forming openings at the bottom.

4. A radiator comprising horizontal tubes, a plurality of vertical plates disposed on the tubes in spaced parallel relation, and a continuous ribbon of metal having an outlet opening, attached to the edges of the plates and extending up the front across the top and down the back of the radiator with the outlet opening near the top thereof and with its ends spaced to provide an inlet opening at the bottom thereof.

5. A radiator comprising horizontally disposed tubes, pairs of plates disposed on said tubes, the pairs being in spaced parallel relation and the plates of each pair being disposed in juxtaposition with their edges hooked toward each other to constitute slots, and a strip of metal having hooked edges disposed between adjacent pairs of plates with the hooked edges interlocked in the slots to constitute the front of the radiator.

6. A radiator comprising horizontally disposed tubes, pairs of plates disposed on said tubes, the pairs being in spaced parallel relation and the plates of each pair being disposed in juxtaposition with their edges hooked toward each other to constitute slots, and a strip of metal having hooked edges disposed between adjacent pairs of plates with the hooked edges interlocked in the slots at the front and back of the radiator to constitute a continuous front, top and back ribbon.

7. A radiator comprising vertical plates disposed in spaced parallel relation and having aligned spaced openings, a plurality of tubes disposed in horizontal position through the openings and joined to the plates in heat-conducting manner, and a plurality of ribbons of metal attached to the edges of the plates to constitute the exterior of the radiator.

8. A radiator comprising vertical plates disposed in spaced parallel relation and having aligned spaced openings, a plurality of tubes disposed in horizontal position through the openings, and a plurality of continuous ribbons of metal attached to the edges of the

plates in heat-conducting manner and extending around the radiator to constitute the exterior surface thereof.

9. A radiator comprising vertical plates disposed in spaced parallel relation and having aligned spaced openings, a plurality of tubes disposed in horizontal position through the openings, a ribbon of metal having outwardly turned flanges disposed between the edges of adjacent plates, and means for clamping the flanges to the edges of the plates.

10. A radiator comprising vertical plates disposed in spaced parallel relation and having aligned spaced openings, a plurality of tubes disposed in horizontal position through the openings, a ribbon of metal having outwardly turned flanges disposed between the edges of adjacent plates, and a U-shaped strip disposed to clamp the flanges of adjacent ribbons to the edge of said plates.

11. A radiator comprising vertical plates disposed in spaced parallel relation and having aligned spaced openings, a plurality of tubes disposed in horizontal position through the openings, a continuous ribbon of metal having outwardly turned flanges disposed between adjacent plates and extending up the front, across the top and down the back to constitute the exterior surface of the radiator, and a U-shaped clamping strip disposed to fit over and clamp the flanges of adjacent ribbons to the edge of the interjacent plate.

12. A radiator comprising vertical plates disposed in spaced parallel relation and having aligned spaced openings, tubes disposed through the aligned openings for conveying heating medium, and a continuous ribbon of metal disposed between adjacent plates and having at one side an outwardly turned flange abutting the side of one plate near its edge and at the other side a flange of U-shape extending outwardly past the edge of the plate and bent around and inwardly to engage and clamp the flange on the adjacent ribbon to the plate.

13. A radiator cabinet comprising a plurality of spaced transverse plates, and a plurality of strips of metal rigidly and permanently connected in heat-conducting relation between the edges of adjacent plates to constitute the exterior surface of the cabinet.

14. A radiator cabinet comprising a plurality of spaced transverse plates, a strip of metal rigidly and permanently connected in heat-conducting relation to the edges of adjacent plates to constitute the exterior surface of the cabinet, and a heating element within the cabinet joined to the transverse plates in heat-conducting manner.

15. A radiator comprising a heating element consisting of a tube adapted to conduct a hot fluid, a series of plates mounted in parallel transverse heat-conducting relation upon the tubular element, and a sheet metal wall-forming member extending up one side, over the top, and down the other side, rigidly interlocked with the outer edges of the said transverse plates having outlet openings near the top and having its ends spaced apart at the bottom to provide an air inlet, forming a cabinet enclosing the heat-conducting element and the plates.

16. A radiator comprising a heating element consisting of a tube adapted to conduct a hot fluid, a series of fins mounted in parallel transverse heat-conducting relation upon the tubular element, a series of plates mounted in parallel transverse heat-conducting relation upon the tubular element interspersed between the fins and having their outer edges extending beyond the outer edges of the fins, and a sheet metal wall-forming member extending up one side, over the top, and down the other side, rigidly interlocked with the outer edges of the said transverse plates, having outlet openings near the top and having its ends spaced apart at the bottom to provide an air inlet, forming a cabinet enclosing the heat-conducting element, the fins, and the plates.

In testimony whereof, we hereunto sign our names.

ARCHIBALD H. DAVIS, JR.
PAXSON WINSBOROUGH.