May 8, 1934. A. H. DAVIS, JR., ET AL 1,957,703

RADIATOR

Original Filed Sept. 11, 1931 2 Sheets-Sheet 1

Fig. 1

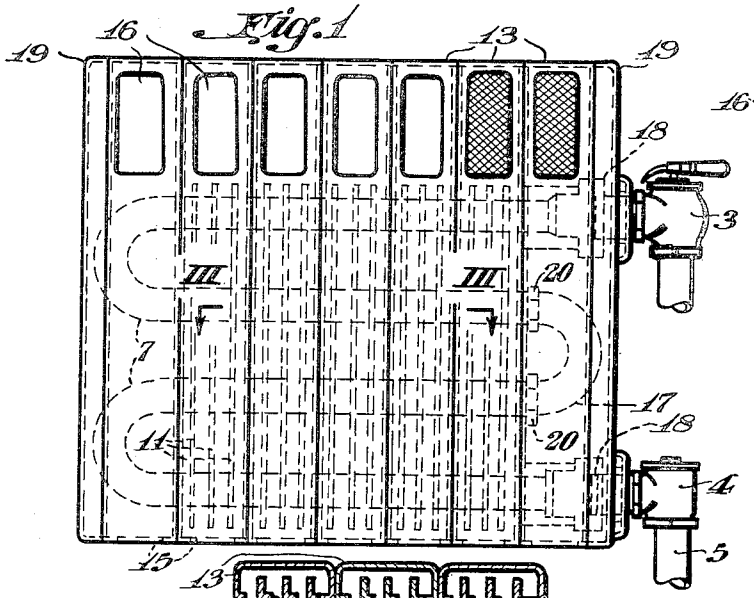


Fig. 2

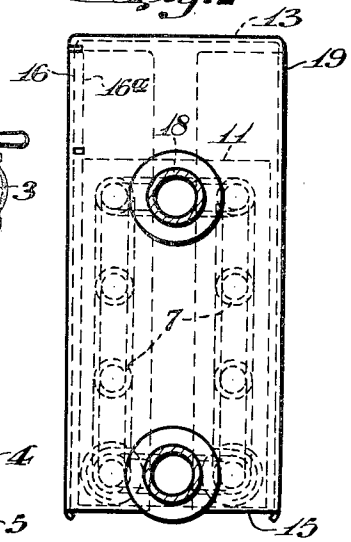


Fig. 3

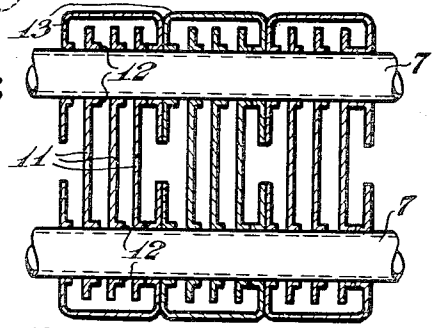


Fig. 5

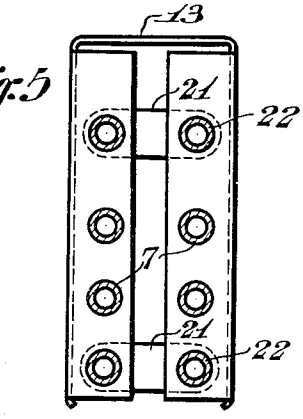


Fig. 4

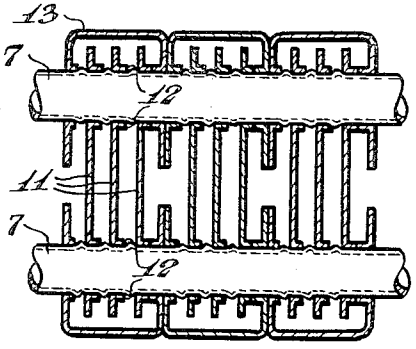


Fig. 6

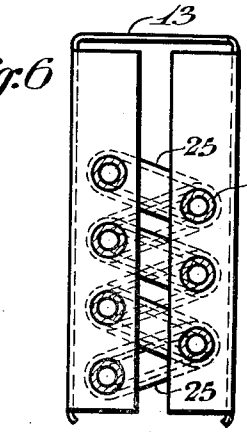
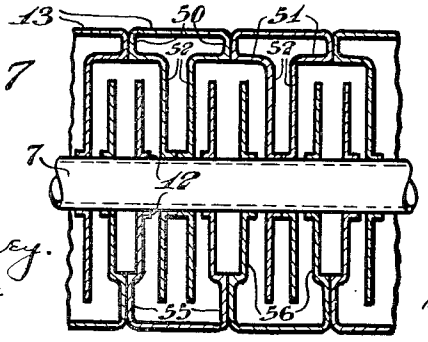


Fig. 7



WITNESSES
E. J. Maloney.
J. R. Langley

INVENTORS.
ARCHIBALD H. DAVIS, JR.,
PAXSON WINSBOROUGH

BY.
Brown, Critchlow & Flick
ATTORNEYS.

May 8, 1934. A. H. DAVIS, JR., ET AL 1,957,703

RADIATOR

Original Filed Sept. 11, 1931 2 Sheets-Sheet 2

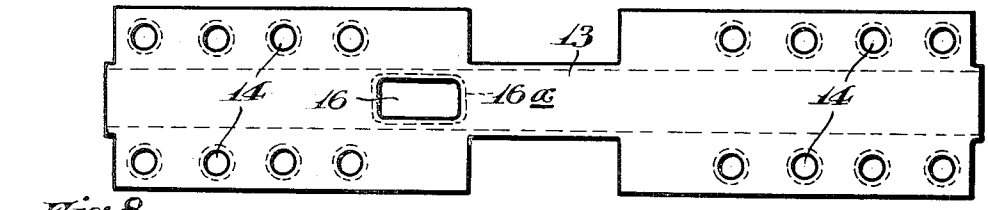


Fig. 8



Fig. 9

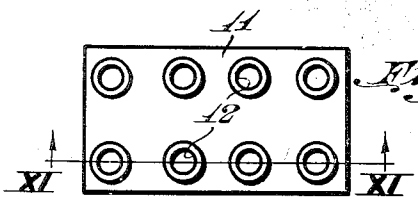


Fig. 10



Fig. 11

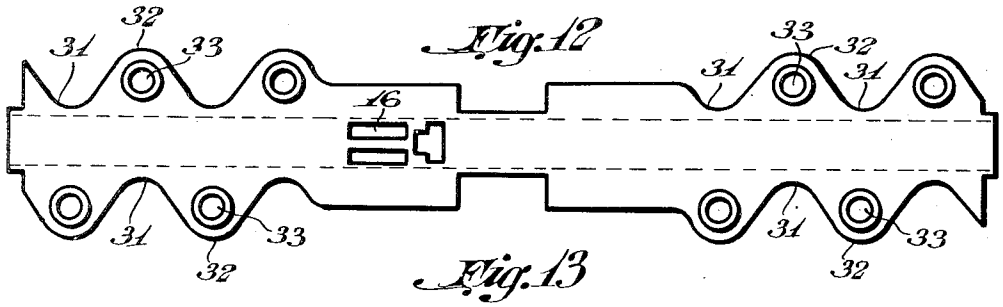
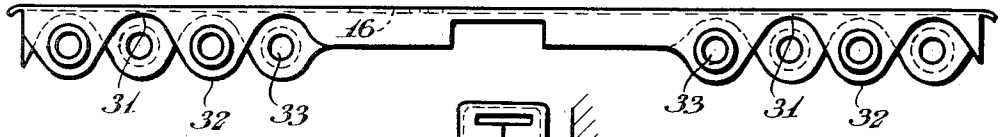


Fig. 12

Fig. 13



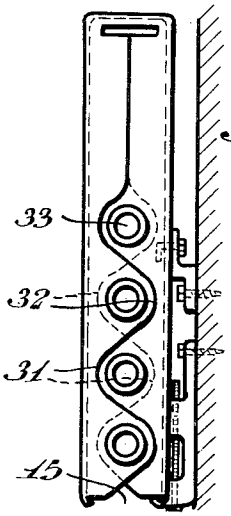


Fig. 14

WITNESSES.
E. J. Maloney.
J. R. Langley

INVENTORS
ARCHIBALD H. DAVIS, JR.,
PAXSON WINSBOROUGH.
BY
Brown, Critchlow & Flick
ATTORNEYS.

Patented May 8, 1934 1,957,703

UNITED STATES PATENT OFFICE

1,957,703

RADIATOR

Archibald H. Davis, Jr., New Castle, and Paxson Winsborough, Pittsburgh, Pa., assignors to Shaw-Perkins Manufacturing Company, Pittsburgh, Pa., a corporation of Pennsylvania

Original application September 11, 1931, Serial No. 562,308. Divided and this application May 15, 1933, Serial No. 671,073

7 Claims. (Cl. 113—118)

This invention relates generally to heat exchange apparatus and particularly to improved radiators for heating the rooms of buildings.

The subject matter of the present application is closely related to that of our copending application Serial No. 562,308, filed September 11, 1931, of which this application is a division.

The general object of our invention is to provide a method of manufacturing rugged and effective sheet metal heating radiators. Another object of our invention is to provide an improved method of manufacturing unitary radiator structures. A further object is to provide a method of manufacture by means of which a self-contained radiator in which a cabinet, extended surface heating elements, and a tube for circulating heated fluid, are joined together to constitute a unitary structure.

In accordance with the present invention, there is provided a heating element, preferably a plurality of tubes of circular cross section disposed in horizontal position one above another in a vertical plane. By means of suitable end connections the tubes are joined to constitute single or multiple continuous passageways for heat conveying fluid. A unitary cabinet structure, which also functions as a radiating surface, is made in a plurality of sections which completely enclose the tubes.

Each section is made from a single piece of metal suitably cut and folded to form continuous back, top, and front ribbon-like portions constituting a comparatively narrow strip or panel on the exterior of the radiator. The back and front portions of each section are of substantially channel shape having inwardly bent integral side plates. The side plates are provided with openings for receiving the horizontal tubes in such manner that the sections are joined rigidly to the tube structure.

Any convenient number of sections may be combined to constitute a radiator of the desired size and capacity. The bottoms of the sections are ordinarily left open to permit ingress of air and suitable openings are provided near the top of each section, ordinarily in the front face thereof, for permitting egress of air.

The stated objects of the invention, together with other objects that will become apparent upon further consideration of this specification, may be achieved by the methods of making and assembling the specific structures herein described and shown in the accompanying drawings, in which Fig. 1 is a view in front elevation of a unitary radiator embodying our invention; Fig. 2 is a view in end elevation of the radiator; Fig. 3 is a partial view in horizontal section, taken on the plane represented by the line III—III of Fig. 1; Fig. 4 is a view similar to Fig. 3 showing the tubes expanded to lock the various parts of the radiator together; Fig. 5 is a view in end elevation, similar to Fig. 2, of a radiator embodying a modification of the invention; Fig. 6 is a view similar to Fig. 2 showing another modification of the invention; Fig. 7 is a view in section, similar to Fig. 3, showing a further modification of the invention; Fig. 8 is a plan view of a blank for a section of the radiator, cut from sheet metal and pressed to form flanges thereon; Fig. 9 is a view in elevation of the blank with the back portion and front portion of the section folded to channel shape; Fig. 10 is a plan view of one of the transverse plates; Fig. 11 is a view in section taken on the line XI—XI of Fig. 10 showing the flanged openings in the transverse plates; Fig. 12 is a plan view of a blank for a section of a modified radiator, that has been cut and pressed from sheet metal; Fig. 13 is a view in elevation of the blank shown in Fig. 12 folded to channel shape; and Fig. 14 is a view in end elevation of a radiator made from the blank shown in Figs. 12 and 13.

Referring more particularly to the drawings, the radiator is shown in Figs. 1 and 2 as a unitary structure having a smooth paneled exterior surface. The usual supply pipe 2 for admitting steam or other heating medium to the radiator is connected at one end thereof by means of a control valve 3. At the other end of the heating tube, the usual thermostatic trap 4 is provided for conveying condensed liquid from the radiator to a return pipe 5. From the control valve 3, heated fluid may pass through the radiator by way of one or more horizontally disposed tubes 7, shown in dotted lines in Fig. 1, the runs of which are connected together at their ends to provide single or multiple continuous passageways through the radiator to the outlet trap 4.

The radiator may be supported in any suitable manner, as by a base member or feet (not shown), or it may be mounted on the wall of a room for instance beneath a window, by means of brackets fastened to the wall back of the radiator and disposed to carry the radiator as shown in Fig. 14.

As shown in Fig. 2, the tubes 7 are arranged, in this particular structure, in two banks of four tubes each, extending longitudinally of the radiator and disposed in parallel vertical planes. The tubes are supported in their normal relative positions by means of a plurality of transverse

plates 11, one of which is shown in detail in Figs. 10 and 11. Each of the plates 11 is provided with a plurality of flanged openings 12 suitably spaced and positioned to receive the tubes 7, and to have heat transferring contact therewith. In the particular structure shown, the transverse plates 11 are disposed on the tubes 7 in groups of three plates equally spaced from each other, the groups being spaced at distances substantially equal to twice the distance between individual plates.

Each group of three plates is enclosed by a shell or section 13 that constitutes a portion of the exterior or cabinet structure of the radiator. Each section 13 is formed from a single piece of sheet metal that may be cut from a flat plate, as shown in Fig. 8. Suitable flanged openings 14 are formed by a pressing operation, and the end portions then are bent to channel shape, as shown in Fig. 9, with the openings 14 in the side plates of the channels disposed in alignment.

The entire section is then folded upon itself to the finished shape shown in Fig. 2 with the openings 14 positioned to receive the tubes in heat transferring contact. One bank of tubes is passed through the openings in the side walls of the front portion of the section and the corresponding openings in the plates 11 and the other bank of tubes is passed through the openings in the side walls of the back portion and the aligned plate openings thus locking the sections to the plates 11.

The exposed portions of the section 13 constitute a continuous strip or ribbon extending up the front of the radiator, across the top, and down the back, functioning throughout as an active radiating surface. The lower ends of the front and back portions of the section are turned under to give a rounded appearance to the bottom of the radiator similar to the appearance of the top, but the bottom of each section is left open to provide an inlet opening 15 for air.

As shown in Figs. 1 and 2, the upper portion of each section extends somewhat above the tops of the transverse plates 11 to constitute a flue for promoting convection currents through the radiator. At the front of each section there is fromed an outlet opening 16, bounded by inturned flanges 16*a*, the bottom of which is slightly above the tops of the transverse plates 11. When the radiator is in operation, the heated air within each section moves upward and outward through the opening 16, being replaced by cool air from the room that enters the inlet opening 15.

In manufacturing a radiator of this type, the transverse plates 11 and the sections 13 are formed from sheet metal, as explained hereinbefore, and assembled in their proper relative positions with the corresponding openings 12 and 14 in alignment. The various sections and plates may be held in position by any suitable fixture in such manner that the tubes 7 may be passed through the openings 12 and 14.

Preferably the tubes 7 are formed from drawn copper tubing of circular section, the tubing being cut into lengths of substantially twice the length of the radiator and each length bent upon itself to constitute two spaced horizontal runs connected by an integral return bend, four such tubing sections being utilized in the radiator shown. The double sections may then be inserted in pairs of openings through the structure.

After the four double sections of tubing are placed in their proper positions in the radiator structure, they are connected to one another at their ends by return bend or elbow members 17 which are joined to the ends of the tubing by brazed joints 20 or other suitable fastening means. By means of the return bends 17 the tubing is joined to constitute a single or multiple passageway through the radiator for the heating medium, provided at its ends with connection elements 18, one of which connects to the control valve 3 and the other to the trap 4.

After the radiator has been thus far assembled and all of the connections between the individual tubes 7 have been made, the structure may be secured together by expanding the tube 7 by means of hydraulic pressure to extend it as shown in Fig. 4 in such manner that it closely engages the inner surface of the flanged openings 12 and 14 to hold the elements of the radiator securely in position.

The thermal efficiency of the joints between the tube 7 and the extended surface structure may be increased by soldering or galvanizing the plates and sections to the tubes, the soldering or galvanizing may be done in addition to expanding the tube 7, or the solder may be depended upon to hold the structure together without resorting to other securing means.

After the elements have thus been joined together, suitable end sections 19 may be applied to the radiator to enclose the return bends at the ends of the tubes 7 and to give to the radiator a smooth exterior surface at its ends.

In the modification of the invention shown in Fig. 5, the sections 13 are made in the same manner as are the sections shown in Figs. 1 to 4. However, in this structure no transverse plates need be utilized. To tie the two sides of the radiator together, connecting links or strips 21 are used instead of the transverse plates 11. As shown, the strips 21 are provided at each end with an opening 22 for receiving one of the tubes 7. One strip is disposed to engage at its ends the two top tubes of the vertical banks and another to engage the two bottom tubes, thus holding the radiator securely together. Any convenient number of strips may be used and they may be distributed as desired along the length of the radiator.

Similar strips are utilized in the modification shown in Fig. 6 instead of transverse plates for holding the sections in place. In this structure the tube banks in the two sides of the sections are not the same but are formed from a continuous tube the opposite runs on the two sides being disposed relative to each other in staggered relation. Strips or links 25 are disposed in angular position from the tubes in one bank to the tubes in the other bank thus forming a lattice work structure holding the sides of the sections together. Likewise, in this radiator any convenient number of strips may be used to support the sections and the number of tubes in the tube banks may be varied as desired.

Fig. 7 shows a modification in which intermediate plates or links are dispensed with, the panel sections 13 of the cabinet forming the transverse locking and radiating members by parallel equally spaced interior flanges extending substantially across the cabinet. In this modification the front wall of the panel section has its flanges 50 turned inward at right angles to the front wall for a short distance, then the flanges are bent toward each other to form portions 51 substantially parallel to the front wall, then they are turned at right angles again, forming parallel

flanges 52 extending substantially to the rear wall of the finished section. These flanges have properly positioned flange perforations for receiving the heating tubes 7.

The back wall of the panel likewise has inturned flanges 55 turned inward at right angles and bent to bring the inner parts 56 of the flanges into parallel relation and substantially equally spaced with respect to flanges 52 of the front wall. These rear wall flanges are likewise perforated to receive the tubes 7.

This arrangement provides cross-locking and radiating plates 52 and 56 integral with the panel sections of the radiator cabinet. Uniform spacing and consequent maximum efficiency is provided, while the smooth paneled effect of the cabinet is preserved.

In Figs. 12, 13 and 14 is shown a modification of the invention in which neither transverse plates nor strips are necessary to hold the sides of the sections together. The sections of this radiator are formed from flat material, as shown in Fig. 12, in the said general manner that the sections 13 of Fig. 8 are formed, with the exception that the edges of the sections are indented or scalloped in such way that recesses 31 are provided at the positions to be occupied by alternate tubes. Between the recesses are lugs or projections 32, each having an opening 33 for receiving tube 7. When the sections are folded together, as shown in Fig. 14, the lugs 32 at one side fit into the recesses 31 at the other side to form a substantially continuous transverse wall with openings 33 disposed in the vertical mid-plane of the radiator.

As shown in Figs. 12 and 13, the lugs in one wall of the sections and at one side thereof alternate with the lugs in the other wall and at the same side in such manner that each tube 7 is engaged by one lug at one side of the section in one wall thereof and by one lug at the other side of the section in the other wall. In this way the sections are held together without separate cross pieces and without overlapping of the wall portions. If desired, transverse plates similar to those shown in Figs. 3 and 4 may be disposed within the sections thus formed and freely supported on the tubes 7 for assisting in transmitting heat from the tubes to the air within the sections.

From the foregoing it will be noted that we have provided a simple and efficient method of manufacturing radiators of the enclosed cabinet type to produce a rugged unitary structure.

Others skilled in the art will appreciate that various other modifications may be made in the general method of forming and assembling the heating tubes and enclosing sections without departing from the spirit and scope of the inventioned defined in the appended claims.

We claim:

1. The method of making heat-exchange apparatus that comprises the steps of punching cutting and folding a plurality of strips of sheet metal to form members of substantially channel shape, folding each member on itself to constitute a box-like section having an integral top and aligned openings through its side walls, and disposing the sections on fluid-conducting tubes extending through openings in said channel member to constitute a self-contained cabinet radiator.

2. The method of making heat-exchange apparatus which comprises cutting a plurality of sheet metal blanks in the form of two substantially rectangular end portions connected by a relatively narrow central portion, providing each end portion with a series of openings along the side edges thereof, folding the blanks to form members of substantially channel shape with the openings on opposite sides of each end portion in alignment, folding each member on itself to place said end portions at right angles to said central portion, and then disposing said members on fluid-conducting tubes extending through said openings to constitute a self-contained cabinet radiator.

3. The method of making heat-exchange apparatus which comprises cutting a plurality of sheet metal blanks, providing the blanks with a series of openings along opposite edges thereof, folding the blanks to form members of substantially channel shape with oppositely disposed openings in alignment, folding each member on itself to constitute a box-like section having an integral top, and disposing the sections on fluid-conducting tubes extending through said openings to constitute a self-contained cabinet radiator.

4. The method of making heat-exchange apparatus which comprises forming sheet metal blanks in the form of strips having a relatively narrow central portion, providing holes along the side edges of the end portions of said blanks, bending the side edge portions of each blank having the holes therein to form a channel-like member, folding each member upon itself to constitute a box-like section and then threading said sections on parallel pipes extending through said openings to constitute a cabinet radiator.

5. The method of making heat-exchange apparatus which comprises forming a plurality of sheet metal blanks in the form of strips having side edge portions, punching openings in the said portions, bending the side edge portions of said blanks to form channel-like members, folding said members upon themselves to form box-like sections with adjacent side edge portions interfitting to provide substantially continuous surfaces and then disposing said sections on fluid-conducting tubes inserted through said openings to constitute an enclosed radiator.

6. The method of making heat-exchange apparatus which comprises forming a plurality of sheet metal blanks in the form of strips having side edge portions with projections and recesses therein, punching holes in the side edge portions, bending the side edge portions of said blanks to form channel-like members, folding said members upon themselves to form box-like sections with adjacent side edge portions interfitting to provide substantially continuous surfaces and then disposing said sections on fluid-conducting tubes inserted through the said openings to constitute an enclosed radiator.

7. The method of making heat-exchange apparatus which comprises forming a plurality of sheet metal strips having side edge portions with recesses and projections therein, providing openings in said projections, bending the side edge portions of said strips to form channel-like members, folding the members on themselves to constitute box-like sections with the projections and recesses of adjacent side edge portions interfitting to provide substantially continuous surfaces, and then disposing the sections on fluid-conducting tubes extending through said openings to form a cabinet radiator.

ARCHIBALD H. DAVIS, JR.
PAXSON WINSBOROUGH.