March 29, 1932. A. B. MODINE 1,851,720

HEAT EXCHANGE APPARATUS

Filed March 25, 1927

Fig. 1.

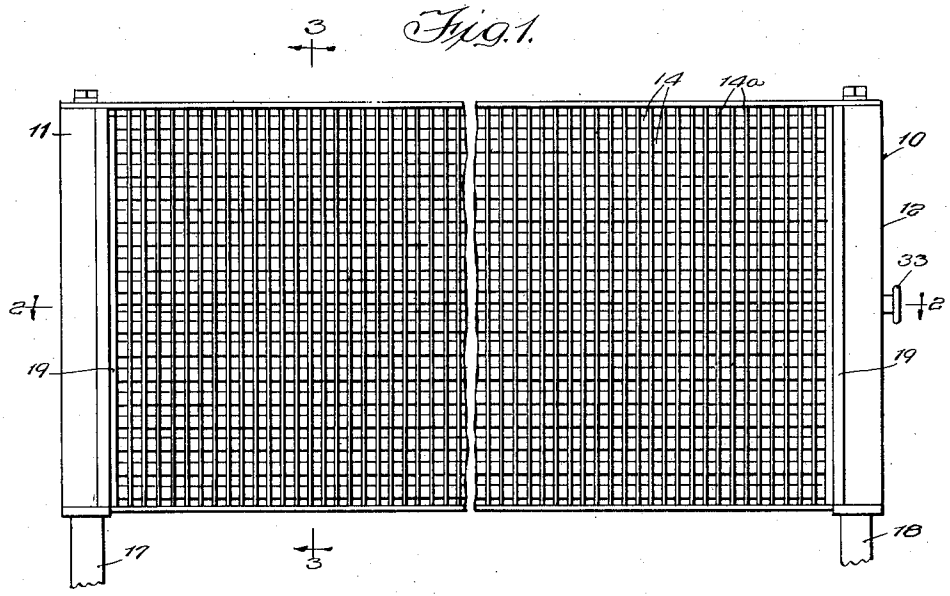


Fig. 2.

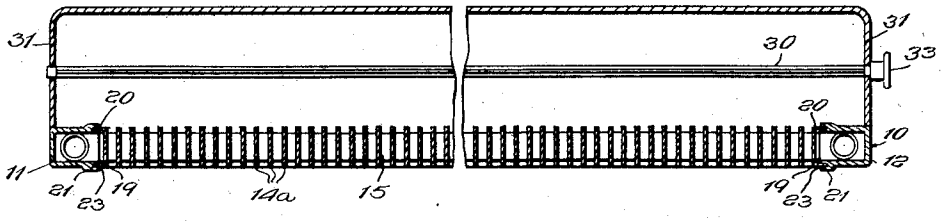
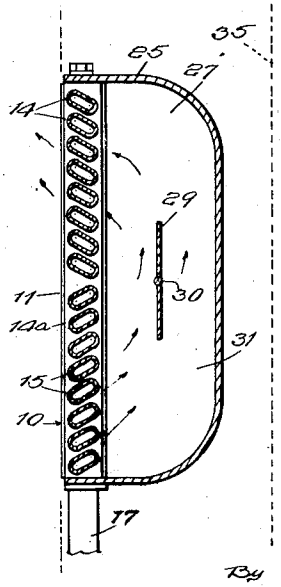


Fig. 3.



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UNITED STATES PATENT OFFICE

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HEAT EXCHANGE APPARATUS

Application filed March 25, 1927. Serial No. 178,491.

My invention relates to heat exchange apparatus and has among its other objects the production of apparatus of the kind described which is convenient, compact, durable, efficient and satisfactory for use wherever found applicable.

A particular object of the invention is to provide improved radiators for heating dwellings, or the like.

Another particular object of the invention is to provide an improved heating unit which may be positioned in the wall of a room or the like and is constructed to induce a circulation of air in the room.

Many other objects and advantages of the construction herein shown and described will be obvious to those skilled in the art from the disclosure herein given.

To this end my invention consists in the novel construction, arrangement and combination of parts herein shown and described and more particularly pointed out in the claims.

In the drawings, wherein like reference characters indicate like or corresponding parts:

Fig. 1 is a front elevation of a radiator embodying the invention;

Fig. 2 is a section taken on line 2—2 of Fig. 1; and

Fig. 3 is a section taken on line 3—3 of Fig. 1.

The reference character 10 designates generally a radiator unit embodying the invention and preferably comprising a plurality of spaced headers or tanks 11 and 12 which communicate with each other through a plurality of tubes 14 and 15. A plurality of vertically disposed plates or fins 14*a* are preferably soldered or otherwise secured to the tubes 14 and 15 to facilitate the exchange of heated fluid passing through the tubes to the air surrounding the tubes. In practice, the radiator 10 is preferably positioned so that the tubes 14 and 15 are disposed substantially horizontal as indicated in the drawings and when the radiator is used in connection with a hot water system, pipes 17 and 18 are provided for connecting the tanks 11 and 12 respectively to the source of hot water. In this instance it is assumed that the hot water enters the tank 11 by way of the pipe 17 and then passes through the tubes 14 and 15 to the tank 12 which discharges the water into the pipe 18. In the event the radiator 10 is to be employed in connection with a steam heating system, the pipe 18 may be employed as a drain pipe, vacuum valves being provided if it is so desired.

As best shown in Fig. 2, the tubes 14 and 15 have their ends secured in header plates 19 which are provided with flanges 20 seated in grooves 21 formed in the tanks 11 and 12, the flanges 20 being preferably soldered to the tanks as indicated at 23.

Secured to the radiator unit 10 is a housing 25 or the equivalent, which cooperates with the radiator unit to form a passage 27, the construction being such that air may enter the passage 27 through the space between the tubes 15 and then pass upward to be discharged from the passage through the space between the tubes 14. This flow of air through the passage 27 is controlled by a damper 29 secured to a rod 30 rotatably journaled in end walls 31 of the housing. A knob or handle 33 is provided upon one end of the rod 30 to permit manual rotation of the rod.

Referring now to Fig. 3, it will be noted that the tubes 14 are arranged in one bank and that the tubes 15 are arranged in another bank, the tubes 14 being disposed above the tubes 15. The tubes 14 and 15 may be of any suitable construction but are preferably formed from relatively thin sheet metal so that when heated fluid is passed therethrough there will be an efficient exchange of heat between the heated fluid and the air surrounding the tubes. Each of the tubes 14 and 15 is preferably of elongated cross section and is preferably arranged so that each has sides arranged at angles to the horizontal and the vertical, the sides of the tubes 14 being arranged to extend in a direction different from that in which the sides of the tubes 15 extend. The arrangement is such that if a heated fluid is circulated through tubes 14 and 15 and there is an exchange of heat between the tubes 14 and 15 and the air surrounding the tubes, this air will be heated and will flow diagonal-

ly upward into the passage 31 and thence to the tubes 14 so that the heated fluid therein may again raise the temperature of the air and cause it to flow diagonally upward out of the passage. The direction in which air normally passes through the improved radiator device is indicated by arrows in Fig. 3. Of course, if the damper 29 is swung into a substantially horizontal position, there will be substantially no flow of air through the passage 27.

It is readily understood that the improved radiator device may be positioned in a recess formed in a wall or the like. Thus, in Fig. 3, I have indicated a wall 35 in dotted lines, the front surface of the radiator unit 10 being disposed substantially flush with one surface of the wall. Obviously, when the improved radiator device is so positioned in the wall of a room, it does not detract from the appearance of, nor use any of the space of the room.

Having thus described my invention, it is obvious that various immaterial modifications may be made in the same without departing from the spirit of my invention; hence I do not wish to be understood as limiting myself to the exact form, construction, arrangement and combination of parts herein shown and described, or uses mentioned.

What I claim as new and desire to secure by Letters Patent is:

1. Heat exchange apparatus comprising a bank of tubes arranged one above the other and adapted to have fluid circulated therethrough, said tubes being of elongated cross-section and being arranged to have sides thereof disposed at angles to the horizontal and the vertical to induce a flow of fluid through said bank when there is an exchange of heat through the walls of the tubes, and a second bank of tubes adapted to have fluid circulated therethrough, said last-mentioned tubes being of elongated cross-section and being arranged to have sides thereof disposed at angles to the horizontal and the vertical to induce a flow of fluid through said second bank when there is an exchange of heat through the walls of its tubes, the flow of fluid through said second bank being in a direction different than the flow of fluid through the first-mentioned bank.

2. Heat exchange apparatus comprising a bank of substantially horizontally disposed tubes adapted to have heated fluid circulated therethrough, said tubes being arranged in spaced relation one above the other in a substantially vertical plane and being formed so that currents of air are induced to flow diagonally upward through said bank when said air is heated by an exchange of heat through the walls of said tubes, a second bank of substantially horizontally disposed tubes adapted to have heated fluid circulated therethrough, said tubes in said second bank being arranged in spaced, relation one above the other and being formed so that currents of air are induced to flow diagonally upward through said second bank when there is an exchange of heat through the walls of its tubes, and means forming a passage extending from the first-mentioned bank of tubes to said second bank of tubes.

3. Heat exchange apparatus comprising a bank of substantially horizontally disposed tubes adapted to have heated fluid circulated therethrough, said tubes being arranged in spaced relation one above the other in a substantially vertical plane and being formed so that currents of air are induced to flow diagonally upward through said bank when said air is heated by an exchange of heat through the walls of said tubes, a second bank of substantially horizontally disposed tubes adapted to have heated fluid circulated therethrough, said tubes in said second bank being arranged in spaced relation one above the other and being formed so that currents of air are induced to flow diagonally upward through said second bank when there is an exchange of heat through the walls of its tubes, means forming a passage extending from the first-mentioned bank of tubes to said second bank of tubes, and means in said passage for controlling the flow of air therethrough.

4. A device of the kind described comprising spaced tanks arranged adjacent a cavity, substantially horizontally disposed tubes extending between the tanks and communicating therewith, and means for operatively connecting said tanks in a heating system to circulate heated fluid through said tubes, said tubes being of elongated cross-section and being arranged one above the other and formed so that currents of air are induced by said tubes to flow between them into and out of said cavity when there is an exchange of heat through the walls of the tubes.

5. A device of the kind described comprising spaced tanks, substantially horizontally disposed tubes extending between the tanks, said tubes being arranged to provide substantially vertically disposed banks arranged one above the other, means forming a passage extending from one of said banks, one of said banks being arranged to induce the flow of air into said passage and the other of said banks being arranged to induce a flow of air out of said passage, and means in said passage for controlling the flow of air therethrough.

6. A heat exchange device comprising vertically spaced radiating members, means cooperating with said members to form a passage to one side thereof, said members providing means for directing a current of air into and out of said passage through the spaces between said members, said current passing in contact with said members in both its inward and outward passage.

7. A heat exchange device comprising

spaced radiating members having passages disposed angularly with respect to the horizontal and vertical planes, and means cooperating with said members to form a passage to one side thereof, said members functioning to direct a current of air between said members into said second mentioned passage and out of said second mentioned passage through said spaces between said members.

8. A heat exchange device comprising spaced radiator members, and means cooperating with said members to form a space to one side thereof, said members having passages directed upwardly and inwardly toward said space and passages directed upwardly and outwardly from said space.

9. A heat exchange device comprising banks of radiating members, the radiating members of one bank being arranged in substantial vertical alignment with the radiator members of the other bank and the radiating members of one bank being inclined relatively to the other bank, and means connecting said banks arranged at one side thereof providing a passage between said banks.

10. A heat exchange device comprising a plurality of banks of radiating members, the radiator members of one of said banks being arranged in substantial vertical alignment with the radiator members of the other bank and the radiator members of one of said banks being inclined in a direction opposite to the inclination of the other of said banks, and means connecting said banks arranged at one side thereof providing a passage between said banks.

11. A heat exchange device comprising a plurality of banks of radiator tubes elongated in cross section, the tubes of one bank being inclined to the tubes of the other bank, one bank of tubes being arranged in substantial vertical alignment with the other, and means connecting said banks arranged at one side thereof and providing a passage between said banks, the tubes of one bank providing a means for directing a current of air into said casing and toward the other bank.

In testimony whereof, I have hereunto signed my name.

ARTHUR B. MODINE.