Nov. 22, 1932. R. S. WENTWORTH 1,888,545

HEATING CONVECTOR

Filed Feb. 7, 1931 2 Sheets-Sheet 1

FIG. 1.

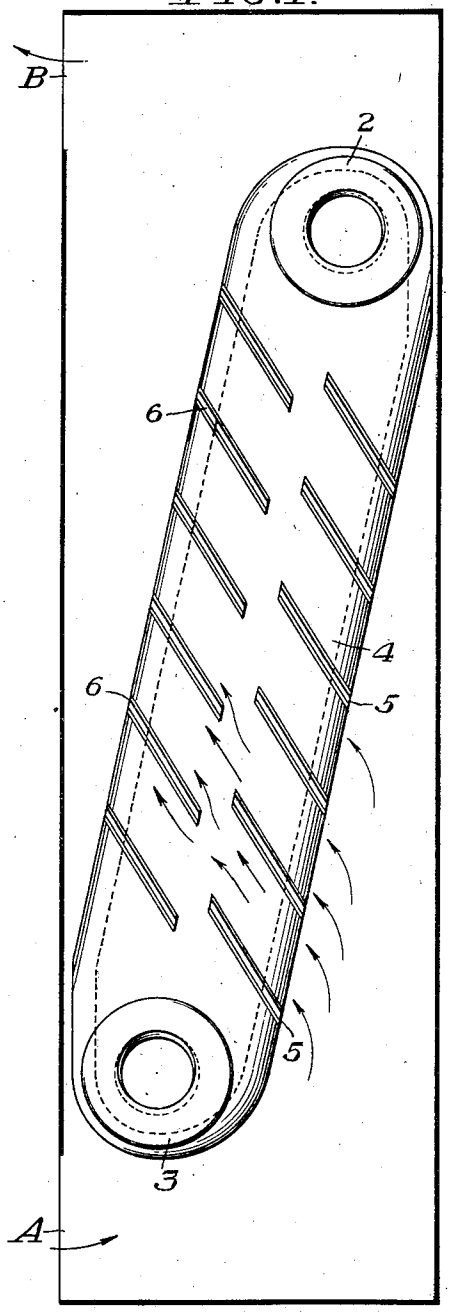
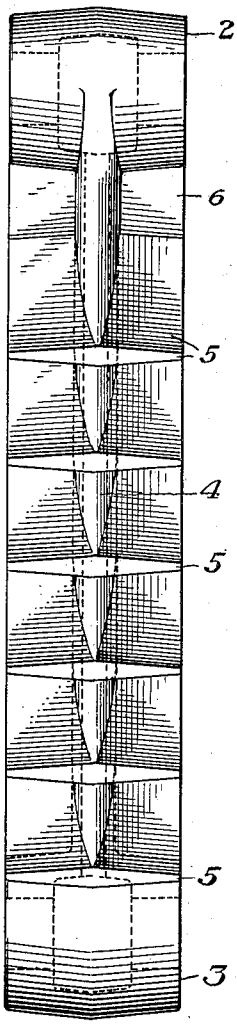


FIG. 2.



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FIG. 3.

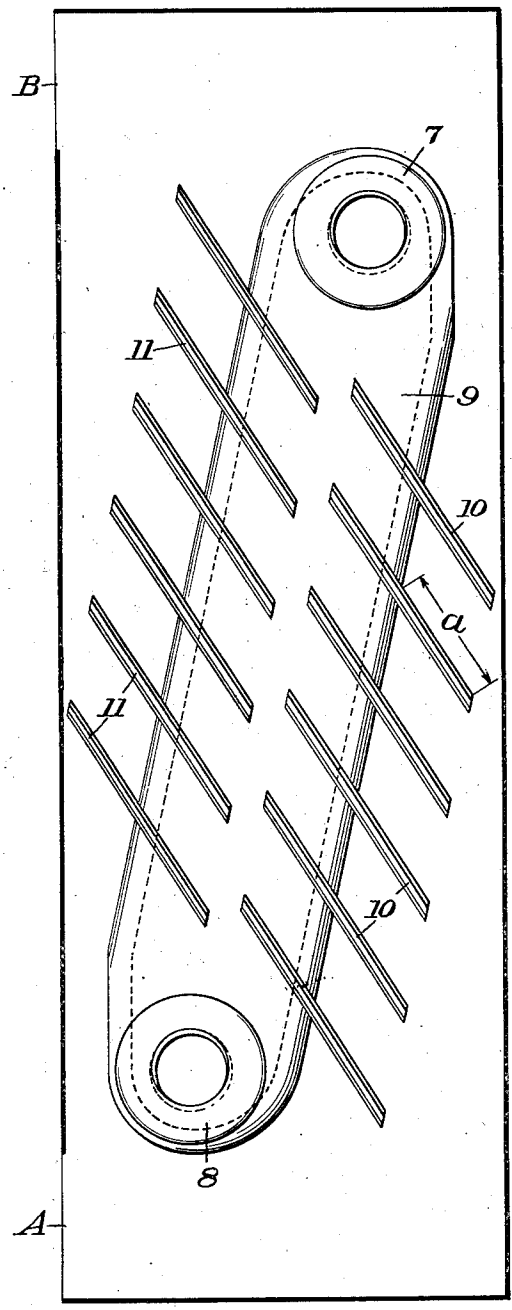


FIG. 4.

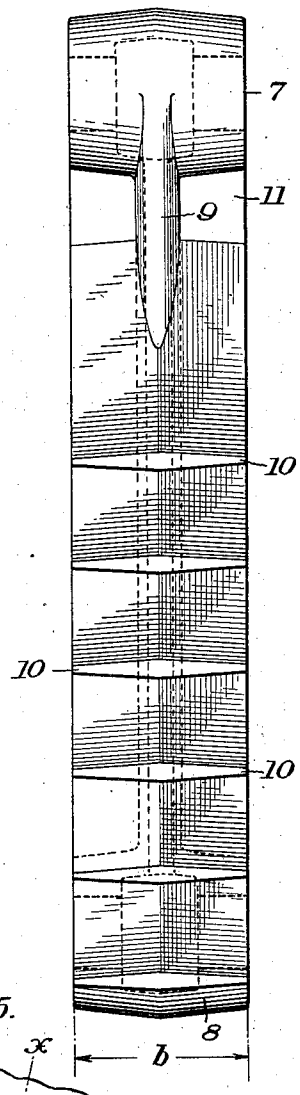
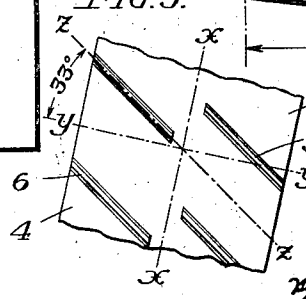


FIG. 5.



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UNITED STATES PATENT OFFICE

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HEATING CONVECTOR

Application filed February 7, 1931. Serial No. 514,164.

This invention relates to space heaters, and more particularly to radiators of the type known in the art as convectors.

Convectors are most commonly designed for use in enclosures, such as cabinets of sheet metal, or cabinets built into the wall of a house or building specially adapted to receive the radiator, said cabinets having a lower opening at the floor level and having an upper opening above the top of the radiator. A highly efficient but expensive type of convector radiator is now commercially available which is fabricated from copper tubes and sheet metal radiating fins, these radiators being very compact and highly efficient.

Efforts have been made to provide cast iron convectors which can be used in an equally small space with fairly comparable results, because of the lower cost of the cast iron and its greater resistance to acid corrosion and also its known ability to stand up in radiating systems for many years.

Cast iron is also preferable because of its greater strength and the fact that it is less likely to be damaged in shipping, handling, or in the making of the installations.

In my copending application Serial No. 513,883, filed February 6, 1931, I have disclosed a convector formed of a plurality of sections joined together, these sections having a header portion at the bottom thereof and a header portion at the top, the headers being connected by a barrel. The radiator has the upper portion thereof laterally offset with respect to the lower portion so that the longitudinal axis of the barrel is inclined away from a vertical plane. Transversely extending continuous fins are provided on each side of the barrel, these fins being set at an angle with respect to both the longitudinal and the transverse axis of the barrel. In order to provide a maximum amount of extended area it is desirable that the fins should have considerable width relative to the thickness of the metal and relative to the volume of the barrel.

In order to reduce the weight it is desirable that the fins be as thin as possible. In order to provide a maximum of extended area they must be spaced rather closely together. However, they should not be spaced so closely together that dust can build-up across the fins and choke the passageways between them.

I have found that it is very difficult to cast sections as disclosed in my said application with a continuous fin thereacross on a commercially practical basis because of the fact that a large number of defective castings result. A single imperfect fin makes the casting commercially unsalable and the casting of sections as disclosed in my said application resulted in the production of a high percentage of sections having defective fins. This is due largely to the fact the the casting is made in a sand mold. The impression in the mold is of course made by a pattern which has fins theron, which fins make cavities in the sand, and when the hot metal is poured into the mold, the metal fills the mold cavity and flows into all of the recesses. The fins are placed quite closely together, so that the body of sand between the adjacent fin-forming cavities is relatively weak, and the metal flowing into one cavity may displace the sand, closing up another fin-forming recess in another.

According to the present invention I have provided a section which will have all of the advantages of the section disclosed in my said copending application, but which will produce more heat per pound of metal, which will have less weight for the same sized section, and which can be cast very much more easily and with very small loss due to the formation of imperfect fins.

The invention may be readily understood by reference to the accompanying drawings, in which

Figure 1 is a more or less diagrammatic view showing a front elevation of a radiator section embodying my invention and showing in outline the arrangement of the cabinet in which the section is adapted to be used;

Figure 2 is a side elevation of the section shown in Figure 1;

Figure 3 is a view similar to Figure 1 of a modified form of section;

Figure 4 is a view similar to Figure 2 of the section shown in Figure 3; and

Figure 5 is a fragmentary view showing a portion of the barrel and showing the preferred angular relationship between the fins and the longitudinal and transverse axes of the section.

Referring first to the section shown in Figures 1 and 2, the radiator section has an upper header portion 2 and a lower header portion 3 connected by a barrel 4, this barrel being preferably thin and flat in cross-section and setting edgewise in the radiator. As shown in Figure 2, the maximum thickness of the barrel in the direction in which the headers run is considerably less than the corresponding dimension of the headers. The section is provided on each face of the barrel with two series of fins, the fins of one series being designated 5 and those of the other series being designated 6. The lower series of fins 5 are staggered with respect to the fins 6. The fins of each series do not extend quite to the center line of the section so that there is a parting space along the center of the section between the inner ends of the fins of the two series. The fins of the two series slope at the same angle, the fins being inclined with respect to both the longitudinal and the transverse axis of the barrel.

The fins arranged in this manner give more efficient heating than the continuous fins extending from one edge of the barrel to the other for the reason that the air entering from the bottom of the radiator enters the space between the fins as shown by the arrows. The film of air immediately adjacent the surface of the fins is heated most, drawing along with it the intermediate body of air which is less effectively heated. With the present arrangement this column of air travelling between the lower series of fins is divided by reason of the staggering of the upper series of fins with reference thereto, and the air which is heated the least in passing between the lower series of fins comes directly into contact with the upper series of fins.

Inasmuch as the rate of heat transfer is proportional to the temperature difference between the metal and the air, it will be seen that a higher amount of heat is absorbed by the air by reason of this dividing of the stream than where the column of air flows without any interruption with the hottest air staying closest to the fins and therefore absorbing less heat in the latter portion of its travel.

The sections can be much more easily cast with a lower loss due to defective fins, because of the fact that there is a continuous rib of sand in the mold between the ends of the depressions in the mold which form the fins along the center line of the mold cavities. This rib of sand adds materially to the support of the sand which immediately surrounds the fin-forming recess in the mold.

Actual foundry practice has disclosed that a relatively few sections cast in this way will have defective fins, whereas where the fins are continuous such a large percentage of castings are defective as to make the cost of the good castings very considerable.

A section made in accordance with the present invention weighs slightly less than a section of similar dimension having continuous straight ribs across it due to the elimination of the metal of the fins along the center of each side of the section. While this elimination of the metal also reduces the extended heat dissipating surface of the section, the more efficient disposition of the fins offsets the elimination of a small portion of the area so that there is a greater total heat emission in a section embodying the present invention than if the fins were continuous and not staggered, and a still higher emission per pound of metal.

In Figure 1 I have indicated the contour of a cabinet showing more or less diagrammatically the manner in which the sections are disposed within the cabinet. The air enters the opening A at the bottom of the cabinet, this opening preferably being located about the floor level in which the radiator is installed. It passes upwardly under the underside of the radiator and rises upwardly and forwardly between the fins, emerging through an opening B at or near the top of the cabinet. The inclination of the section at this angle approaches the heating efficiency of a horizontally extending section of the same dimension having vertical fins with the advantage, however, that the cabinet does not have to be as deep as it would be if the sections were arranged horizontally.

In the arrangement shown in Figures 3 and 4 I have retained the advantages of the construction shown in Figures 1 and 2 except that I provide for a considerably greater amount of extended radiating surface in proportion to the amount of prime radiating surface than is provided in the arrangement shown in Figure 1. This results in a higher efficiency per pound of metal employed. While I have shown the section in Figure 3 as being the same size as the section shown in Figure 1, it is actually possible to use a relatively smaller barrel in the arrangement shown in Figure 3 and by reason of the greater extended area, have as much effective heat dissipating surface.

In the arrangement shown in Figure 3 the section is of the same construction as that shown in Figure 1, there being an upper header 7, a lower header 8, and a connecting barrel 9. There are two series of fins 10 and 11 corresponding to the series of fins 5 and 6 of Figure 1, but the fins are extended considerably beyond the edges of the barrel.

I prefer that the fins shall project beyond the barrel a distance sufficient to give a materially increased heat radiating surface. At

the same time, if extended too far, the outer portion of the extended area is so far distanced from the barrel as to receive relatively little heat and therefore, if the fins are extended too far beyond the prime surface, there is merely added weight without a corresponding increase in efficiency. The fins are therefore not extended to a distance beyond which they will have practical usefulness nor to a distance where they introduce unnecessary losses into the casting of the sections.

As explained in my said copending application, the fins are most effectively disposed where they are at an angle ranging between 27 to 45° to the plane of the transverse axis of the section. A still more preferable range is between 30 to 38°, and I have found that if this angle is 33° the section is best adapted for use in the different inclinations to which it may be set due to variations in the depth of the cabinet.

In Figure 5 I have illustrated this angularity of the fins with respect to the longitudinal and transverse axes of the section. In Figures 1 and 3 the fins are merely more or less conventionally shown. In Figure 5 the line x—x represents the longitudinal axis of the section, while the line y—y represents a line parallel with the transverse axis. The line z—z is parallel with the fins 5 and 6. The angle y—z should range between 27 and 45°, and more preferably, should be about 33°. The reason for this is fully explained in my said copending application.

The sections are of course reversible, so that they may be turned end for end.

From the foregoing description it will be noted that my invention provides a convector type of radiator section which is more efficient and can be cast much more cheaply than cast metal convector radiator sections as heretofore constructed.

While I have shown and described a particular construction and arrangement of the fins, it will be understood that various changes and modifications may be made as to the number of fins, the spacing of the fins and in other respects, as will be apparent to those skilled in the art.

I claim:

1. A convector section comprising a barrel portion adapted to set in an inclined position having two series of sloped fins therealong, the slope of the fins being at an angle to the transverse and longitudinal axes of the section, one series terminating on one side of the longitudinal axis of the barrel and the other series terminating at the other side of the longitudinal axis thereof, the fins of the two series having their longitudinal axes equi-distantly alternated.

2. A convector section comprising two headers and a connecting barrel having its longitudinal axis sloped so that the upper header is laterally offset with respect to the lower one, said barrel having two series of fins at each side thereof, the fins of one series being staggered with respect to the fins of the other series, the fins of one series lying in planes about half-way between those of the other series, the inner ends of the fins of one series being spaced in a direction longitudinally of the fins from the inner ends of the fins of the other series.

3. A cast metal convector section comprising header portions and a connecting barrel having the longitudinal axis thereof inclined to the vertical and horizontal, said barrel having two series of angularly sloping fins on a side face thereof which extend inwardly from the edges of the barrel toward the center, the inner ends of the fins of the two series being spaced apart longitudinally and transversely of their length.

4. A cast metal convector section comprising header portions and a connecting barrel, longitudinal axis of the barrel being inclined away from a vertical plane, said barrel having two series of fins on a side face thereof which extend inwardly from the edges of the barrel toward the center, the inner ends of the fins of the two series being spaced apart in a direction longitudinally of the fins, the fins also projecting outwardly from the edge of the barrel, the fins of one series being offset with respect to those of the other series so that the longitudinal axes of the fins are equi-distantly separated.

5. A cast metal convector section comprising header portions and a connecting barrel, the longitudinal axis of the barrel being inclined, said barrel having two series of parallel angularly disposed fins on a side face thereof which extend inwardly from the edges of the barrel toward the center, the inner ends of the fins of the two series being spaced apart in a direction longitudinally of the fins, the fins also projecting outwardly from the edge of the barrel, of a distance equal to the length which they project inwardly along the side of the barrel, the longitudinal axes of the fins of one series passing about mid-way between the fins of the other series.

6. A convector section comprising a barrel having a connector portion at each end thereof, said barrel having two series of fins on each side face thereof, the fins of one series being staggered with respect to the fins of the other series on the same side, the corresponding series of fins on the two sides of the barrel being in alinement and being projected outwardly beyond the edges of the barrel as an integral single fin.

7. A cast metal convector section comprising an inclined barrel portion having a connector portion at each end thereof and having two series of parallel fins on a side face thereof, the fins of one series having their axes equi-distantly disposed between the fins

of the other series and having the inner ends thereof spaced from the fins of the other series, said fins being inclined with respect to both the transverse and longitudinal axis of the barrel.

8. A cast metal convector radiator section comprising a barrel portion which is sloped at an angle from a vertical plane and having a header portion at the top therof and a header portion at the bottom thereof, said barrel having two series of fins on at least one side face thereof, the fins of one series being staggered with respect to the fins of the other series, the inner ends of each series of fins terminating to one side of the center line of the barrel whereby the ends of the fins of the two series are in spaced relation, the fins of both series being sloped in the same direction and being inclined with respect to both the longitudinal and transverse axis of the barrel.

In testimony whereof I have hereunto set my hand.

ROBERT S. WENTWORTH.