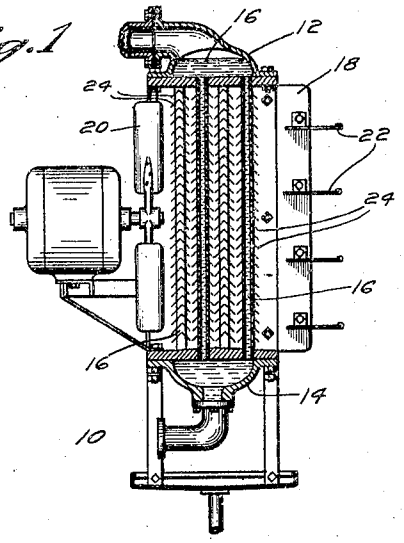
Sept. 5, 1933. K. W. HAUPT 1,925,720

FIN FOR HEAT EXCHANGERS

Filed Dec. 20, 1930

Fig. 1



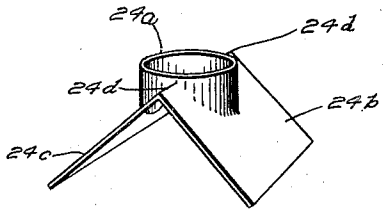


Fig. 2

Fig. 3

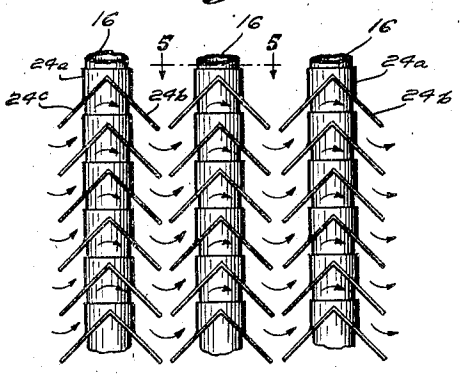
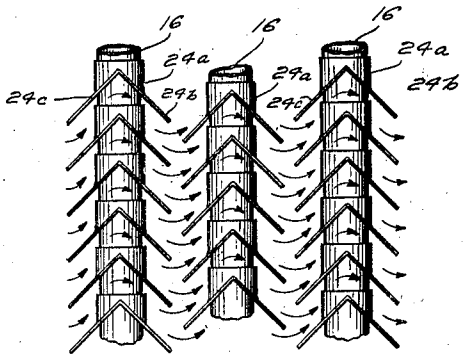


Fig. 4



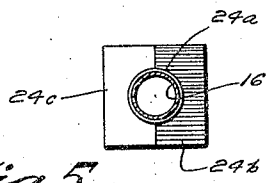


Fig. 5

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UNITED STATES PATENT OFFICE

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FIN FOR HEAT EXCHANGER

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Application December 20, 1930
Serial No. 503,701

1 Claim. (Cl. 257—263)

This invention relates to improvements in fins for heat exchangers.

It has been customary to provide fins on the tubes or pipes of heat exchangers for the purpose of increasing the radiating or absorbing surface presented to the passing medium. It is an object of the present invention to provide a novel shaped fin for this primary purpose which still further increases the effective surface without enlarging the space occupied by the fins. It is also an object to provide fins capable of acting as deflectors whereby the medium flowing past the tubes may be agitated and given a more tortuous course than results from the tubes and fins heretofore employed. And it is a still further object to so shape these fins that when employed in a cooler or evaporator, they cause rapid and substantially complete discharge of the precipitation which occurs during a defrosting of the apparatus.

These objects and the features which characterize the invention are accomplished by making a fin with a body portion adapted to fit snugly about the tube, and with outstanding portions which diverge with respect to the axis of the body portion. These fins may be placed in parallelism on the several tubes, in which case adjacent rows of fins provide a continuous course whose direction is frequently altered. By staggering the fins of successive tubes, the outstanding portions then cause the medium to be still further diverted and intermixed. This deflecting and mingling of the currents results in all parts of the flowing medium coming in actual contact at one time or another with the surfaces of the tubes or fins and thus assures a greater and more effective transfer of the thermal units.

The best mode in which I have contemplated applying the principles of my invention is disclosed in the accompanying drawing, but it is intended that the patent shall cover by suitable expression in the appended claim whatever features of patentable novelty exist in the invention disclosed.

In the drawing,

Figure 1 is a vertical section through a heat exchanger comprising the novel fins of this invention;

Figure 2 is a perspective of the improved fin;

Figure 3 is an elevation showing one arrangement of the tubes and fins;

Figure 4 is another elevation showing a different arrangement, and

Figure 5 is a plan of a tube and its fins as seen from line 5—5 of Figure 3.

Referring more particularly to the drawing, the heat exchanger 10 is here shown as having top and bottom headers 12 and 14 connected by a series of tubes 16. The headers and side plates 18 form about the tubes a housing which is open at both ends. In one opening is placed a fan 20 and the other opening is provided with vanes 22 which may be tilted upward or downward as desired to deflect the treated medium after it has passed by the tubes.

Each tube is provided with a multiplicity of fins 24. Each of the latter has a body portion 24*a* adapted to fit snugly against the outer surface of its tube. Outstanding around this body portion are two flat portions 24*b*, 24*c* which are inclined to the vertical with their upper edges meeting in a common apex or ridge 24*d* at the top. As here shown, the thickness of the fin plate is somewhat exaggerated for clearness.

In case where the primary desire is to drive the greatest amount of air past the tubes, the fins are arranged as in Figures 3 or 4 assuming these figures to be views looking along the axis of the fan. As thus arranged, the fins offer the least resistance to the air and thus enable the maximum amount of air to pass. When, however, the primary purpose is to effect a considerable change in temperature of the passing air, the fins are then placed as seen in Figure 1, or as shown in Figures 3 and 4, now assuming these figures to be views taken transeverse to the fan's axis.

In Figure 3, the corresponding fins on adjacent tubes are all arranged at the same level. The air currents leaving the fan (assuming it to be at the left of the tubes) strike the sloping surfaces of the portions 24*c* and are deflected upward. This causes some of the air to strike the under surface of the fin portion 24*c* immediately above, while another part of the air passes over the ridge and into contact with the under surface of the other portion 24*b* of the same fin. In general, as indicated by the arrows, the currents assume a course between two successive rows of fins, but this course is constantly changing as the air meets the deflecting portions of the fins in its travel. Obviously additional edding of the air is caused and as a result of this increased turmoil substantially all of the air comes in direct contact with the fin and tube surfaces several times during its movement through the exchanger.

In Figure 4 the fins of one tube are at different

levels from the fins on the next tube in the general line of flow. This arrangement accomplishes all the deflecting of the arrangement shown in Figure 3 and in addition causes a further mixing or mingling of the sub-currents formed by the fins, because as the air passes from between adjacent fins on the first line of tubes encountered part of it is deflected upward by the nearest fin on the next row and thence passes above said nearest fin, while the remainder of the air goes by this said nearest fin and encounters the fin below to be thereby deflected so as to pass under said nearest fin. Thus there is a repeated separation and distribution of the air in addition to the deflection and eddying.

It is to be noted that the fins of this invention require no different spacing of the tubes than if flat horizontal fins were used, it being obvious that the projected space covered by each is identical. And yet because of the inclined portions, here shown as 45° to the vertical, the surface area of the outstanding portions is approximately forty per cent greater than if these portions were the usual flat horizontal ones. This increased area of exposed surface is a distinct gain when the exchanger is used as a heater, for then the number of inclined fins may be the same as though flat fins were employed.

When the exchanger is used as a cooler or evaporator, it is necessary to maintain at least a minimum distance between the inclined portions because of the collection of frost on the tubes and fins as the passing air gives up its moisture. This requirement makes the number of inclined fins less than the number of flat fins that might be used on the same length of tube, but this loss in number is made up by the increase in area above noted. Moreover, the inclined fins greatly improve the defrosting of the cooler. This must be done at not infrequent intervals and the simplest way to do it is to cut off the flow of refrigerant to the tubes while the fan continues to run. The relatively warm air thus driven past the tubes quickly melts the frost. When the usual flat or horizontal fins are used this moisture is quite apt to remain on the upper surface of the fin as a very thin film which quickly changes to frost against when the refrigerant is once more flowing in the tubes. With the inclined fin of the invention, no film remains on the fins as the slope of the outstanding portions causes all moisture to run down and drip from their bottom edges as fast as it is formed. Accordingly after a defrosting operation with fins of the invention, the latter are left perfectly dry and because of this the succeeding formation of frost is appreciably delayed.

It is also to be noted that placing the fins at an angle to the axis of the tube increases the extent of actual contact between each fin and the tube. This is advantageous for it aids in the conduction of heat units from one to the other and thereby improves the effectiveness of the exchanger.

I claim:

A fin for a tube having a tubular body portion adapted to engage the tube and a pair of outstanding flat body portions which meet and form a ridge perpendicular to the axis of said tubular body and extend downward therefrom in diverging directions, the lower edges of said flat portions being sharp and free whereby moisture collecting on said fin may drop therefrom.

KARL W. HAUPT.