

June 23, 1942.

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2,287,267

HEAT EXCHANGER

Filed May 18, 1940

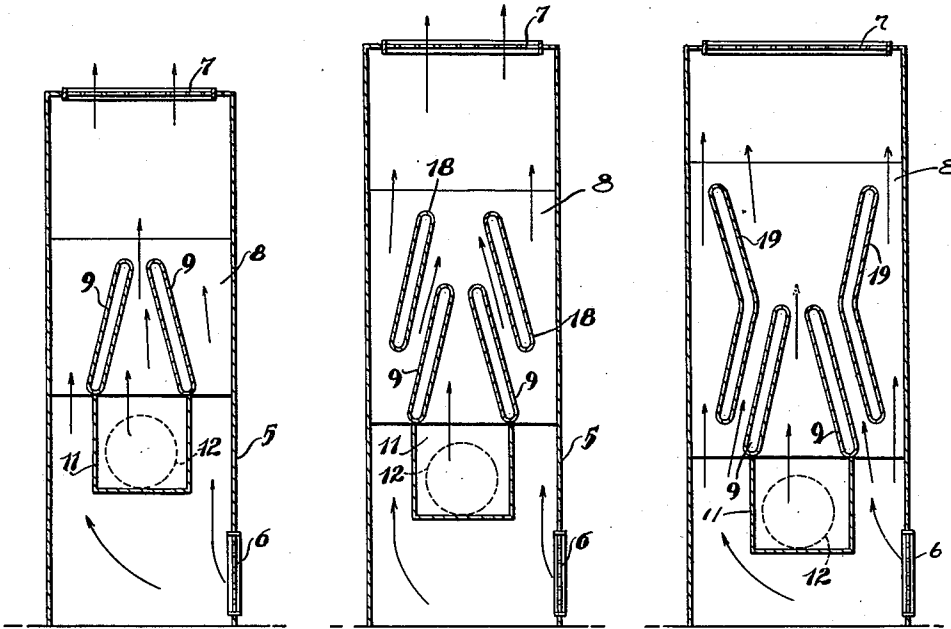


Fig. 1

Fig. 2

Fig. 3

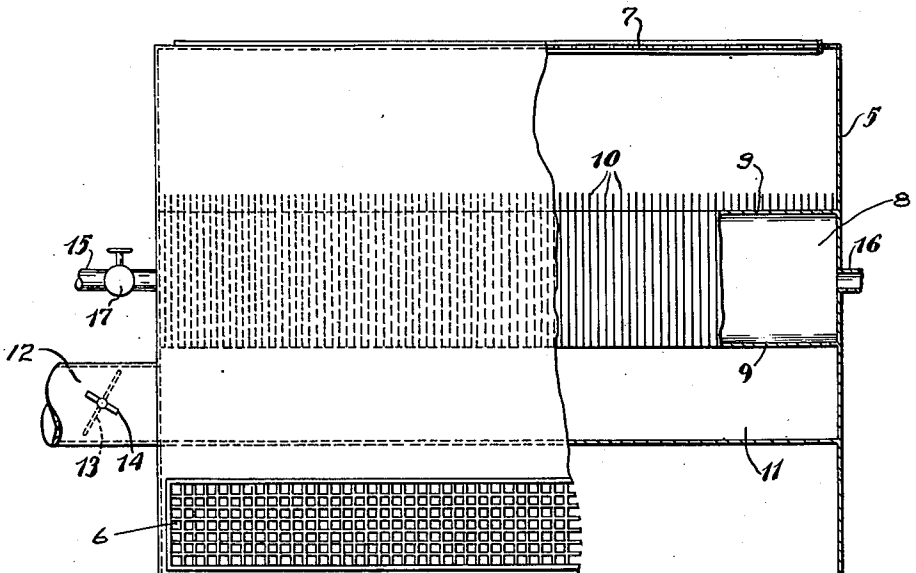


Fig. 4

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2,287,267

HEAT EXCHANGER

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Application May 18, 1940, Serial No. 335,966

9 Claims. (Cl. 257—137)

This invention relates to heat exchangers and provides in heat exchanger surfaces ejectors for inducing with a primary air stream, the flow of recirculated air.

Air conditioning units employing air ejectors in combination with heat exchangers, are in general use. A typical unit of this type is shown by the U. S. Patent No. 2,000,597 which issued May 7, 1935 on an application of R. E. Keyes. Such prior units have employed separate heat exchangers and ejectors, the ejectors usually acting through the passage of primary air there-through, to induce the movement of room air as recirculated air, through the heat exchangers which are regulated for taking care of local heating or cooling requirements. Such arrangements have been very satisfactory for heating duties but much more surface is required for cooling than for heating due largely to the temperatures of the commercially available heat exchange fluids, and when it is desired to provide large proportions of recirculated to primary air, the air resistance of the usual cooling surface is a serious factor.

This invention provides for relatively low air resistance by combining air ejectors in heat exchangers, or in other words, by utilizing heat exchange surfaces for forming the walls of ejector nozzles and of auxiliary passages such as Venturi passages associated therewith.

An object of the invention is to reduce the air resistance of heat exchange units employing air ejectors.

The invention will now be described with reference to the drawing, of which:

Fig. 1 is a vertical section through one embodiment of a heat exchange unit according to this invention;

Fig. 2 is a vertical section through another embodiment of a heat exchange unit according to this invention;

Fig. 3 is a vertical section through another embodiment of a heat exchange unit according to this invention, and

Fig. 4 is a front elevation of the unit of Fig. 1 with portions in dotted outline.

Referring first to Figs. 1 and 4, the rectangular casing 5 of sheet metal has in the lower portion of one wall, the recirculated air inlet grille 6 and has in its top, the air discharge grille 7. The heat exchanger 8 is supported inside the casing 5 and includes the two longitudinally extending, flattened tubes 9 and the plurality of closely spaced fins 10 which are attached to the tubes 9 and provide extended surface therefor. As il-

lustrated, the tubes 9 converge to form an ejector nozzle.

The primary air chamber 11 opens in its upper portion into the space between the tubes 9 for discharging primary air under pressure into the nozzles formed by the tubes. The chamber 11 may receive primary air under pressure from a central source, through the pipe 12. The damper 13 in the pipe 12 may be adjusted by the handle 14 to vary the volume of primary air.

In operation, the discharge of primary air between the tubes 9 causes room air to enter through the inlet 6 and to pass between the fins 10 and between each tube 9 and the adjacent wall of the casing 5, the mixed primary and recirculated air being discharged through the grille 7 to serve the room.

A heat exchange fluid which in winter may be steam, and in summer may be a refrigerant, enters the tubes 9 through the pipe 15 and is conveyed therefrom through the pipe 16, the temperature or volume of the fluid being regulated by the valve 17. The tubes 9 and their extended surface fins 10 are in heat exchange relationship to both primary and recirculated air and effect heat exchange therein. The tubes thus serve as an ejector for inducing air flow and as heat exchangers for changing the temperature of the air.

In the embodiment of Fig. 2, the additional heat exchange tubes 18 are included in the fins 10 and form a converging passage into which the ejector formed by the tubes 9, discharges. The recirculated air passes between the tubes 9 and 18 and between the tubes 18 and the adjacent walls of the casing. More surface is provided and the tubes 18 may aid in the induction action depending upon the static air pressure.

The embodiment of Fig. 3 has the tubes 19 forming a Venturi passage into which the nozzle formed by the tubes 9, discharges. The tubes 19 contact the fins 10 as do the tubes 9 and thus provide heat exchange surface as well as a Venturi passage. This embodiment is suitable for those installations where it is not necessary or desirable to discharge the air at high velocity from the unit.

The combined heat exchange and air inducing surfaces may of course be used in association with other heat exchange surfaces in the recirculated or primary air stream, if in themselves they do not provide enough surface and it is not desired to increase their surface. The total air resistance of the combination will be less than

of prior arrangements utilizing ordinary heat exchangers and ejector arrangements.

While the invention has been illustrated as using flattened tubes, round tubes or other shaped tubes with attached plates for guiding the air could be used.

While embodiments of the invention have been described for the purpose of illustration, it should be understood that the invention is not limited to the exact apparatus and arrangement of apparatus described as modifications thereof may be suggested by those skilled in the art without departure from the essence of the invention.

What is claimed is:

1. In a heat exchange unit having an outlet, a primary air inlet, a recirculated air inlet and an ejector for inducing the flow of air through said recirculated air inlet, with air from said primary air inlet for discharge through said outlet, heat exchange surfaces forming a Venturi air passage in the path of the air discharged by said ejector.

2. In a heat exchange unit having an outlet, a primary air inlet and a recirculated air inlet, heat exchange surfaces shaped to form an ejector for inducing the flow of air through said recirculating air inlet with air from said primary inlet for discharge through said outlet, and other heat exchange surfaces forming an air passage in the path of the air discharged by said ejector.

3. In a heat exchange unit having an outlet, a primary air inlet and a recirculated air inlet, heat exchange surfaces shaped to form an ejector for inducing the flow of air through said recirculated air inlet for discharge through said outlet with air from said primary inlet, and other heat exchange surfaces forming a converging air passage in the path of the air discharged by said ejector.

4. In a heat exchange unit having an outlet, a primary air inlet and a recirculated air inlet, heat exchange surfaces shaped to form an ejector for inducing the flow of air through said recirculated air inlet for discharge through said outlet with air from said primary inlet, and other heat exchange surfaces forming a converging Venturi passage in the path of the air discharged by said ejector.

5. In a heat exchange unit having an outlet, a primary air inlet and a recirculated air inlet, a heat exchanger having internal heat exchange fluid passages and having external air contacting surfaces, said external surfaces converging to form an air ejector, and means for directing air from said primary air inlet through said ejector, for inducing the flow of air through said recirculated air inlet for discharge through said outlet.

6. In a heat exchanger having an outlet, a recirculated air inlet and a primary air inlet, a pair of heat exchangers having internal heat exchange, fluid passages, and having external air contacting surfaces which converge towards each other forming an ejector, and means for directing air from said primary air inlet through said ejector, for inducing the flow of air through said recirculated air inlet for discharge through said outlet.

7. In a heat exchange unit having an outlet, a primary air inlet, and a recirculated air inlet, a heat exchanger having internal heat exchange fluid passages and having external air contacting surfaces, said external surfaces being shaped to form an ejector nozzle, means forming a passage connecting with said recirculated air inlet for conducting air therefrom past said exchanger, and means forming a primary air passage connecting said primary air inlet and said nozzle for conducting primary air into said nozzle for inducing the flow of recirculated air past said nozzle for discharge through said outlet, said last mentioned means separating said passages whereby recirculated air cannot enter said primary air passage and said nozzle.

8. In a heat exchanger having a recirculated air inlet and a primary air inlet, a pair of heat exchangers having internal heat exchange fluid passages and having external air contacting surfaces, said exchangers being shaped to form between adjacent air contacting surfaces thereof, an ejector nozzle, means forming a passage connecting with said recirculated air inlet for conducting air therefrom past said exchangers, and means forming a primary air passage connecting said primary air inlet and said nozzle for inducing the flow of recirculated air past said nozzle for discharge through said outlet, said last mentioned means separating said passages whereby recirculated air cannot enter said primary air passages and said nozzle.

9. In a heat exchange unit having an outlet, a primary air inlet and a recirculated air inlet, a heat exchanger having an internal heat exchange fluid passage and having an external air contacting surface, means forming a passage connecting with said recirculated air inlet for conducting air therefrom past said exchanger into said outlet, means including said external surface forming an ejector nozzle, means forming a primary air passage connecting said nozzle and said inlet, said last mentioned means separating said passages whereby recirculated air cannot enter said primary air passage and said nozzle.

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