March 28, 1944. C. R. KEEP 2,345,536

HEAT EXCHANGE UNIT

Filed May 16, 1942

Fig. 1.

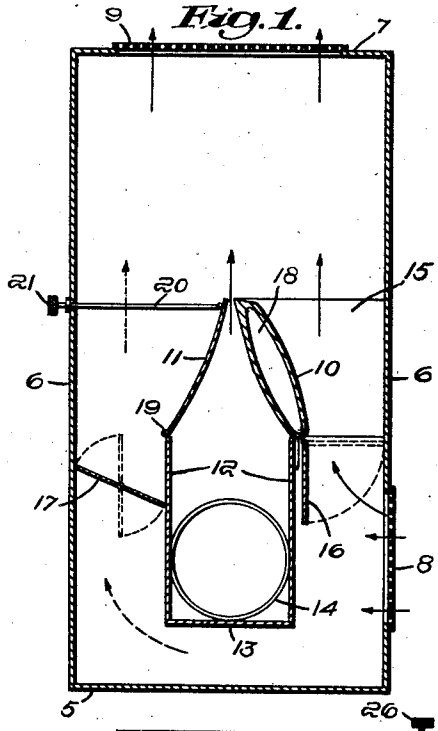


Fig. 2.

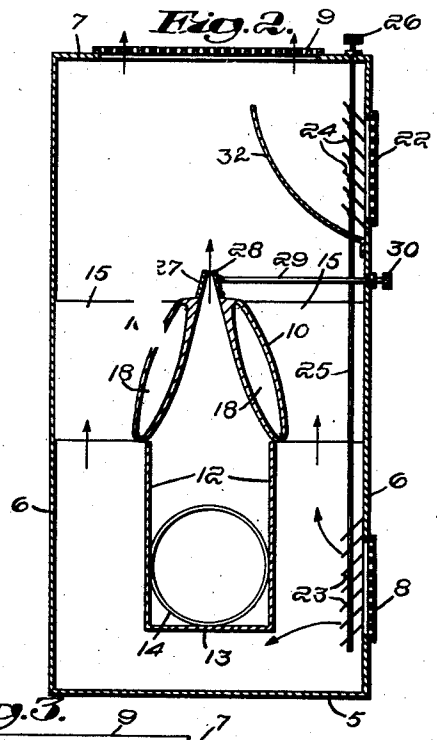
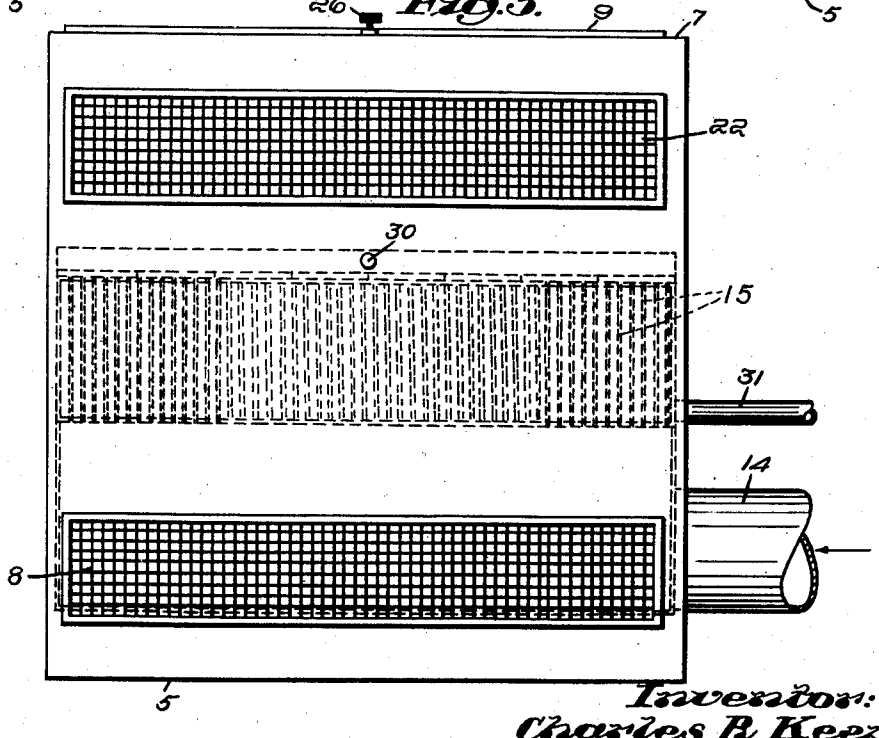


Fig. 3.



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HEAT EXCHANGE UNIT

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Application May 16, 1942, Serial No. 443,203

4 Claims. (Cl. 257—137)

This invention relates to heat exchange units of the type which contain air ejector nozzles through which primary air from a central source is supplied for inducing the flow into the units, of recirculated air.

The copending Palmer Patent No. 2,287,267 which issued June 23, 1942 discloses such a unit in which the external surfaces of the heat exchange tubes are shaped and arranged to form the ejectors for inducing the flow of recirculated air. The present invention provides improvements over the features disclosed in said application and which modify same for overcoming difficulties of commercial operation.

A feature of this invention resides in providing for varying the induction effect of ejector nozzles utilizing surfaces of heat exchange tubes. In one embodiment of the invention this is accomplished by using an elongated heat exchange tube as one wall of an ejector nozzle, the other wall being provided by a pivoted sheet metal member which is adjustable about its pivot for varying the spacing between the ejector walls and thus varying the ejector effect. In another embodiment of the invention, the opposite walls of the ejector nozzle are formed by elongated heat exchange tubes, one or both of the tubes having extensions at the tips thereof and one of the extensions being pivoted for varying the spacing between the nozzle tips and thus varying the ejector effect.

Another feature of the invention resides in providing an air by-pass around an ejector nozzle which includes one or more heat exchange tubes as an element or elements thereof. In one embodiment of the invention an air by-pass is provided within a unit, around an air ejector nozzle utilizing a heat exchange tube as one wall. In another embodiment of the invention utilizing heat exchange tubes as opposite walls of an ejector nozzle, an air by-pass is provided by utilizing two recirculated air inlets, one below and the other above the ejector.

Objects of the invention are to improve the efficiency of and to reduce the cost of, heat exchange units of the type which include ejector nozzles for inducing the flow of recirculated air.

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

Fig. 1 is a cross sectional view through one embodiment of a heat exchange unit incorporating features of this invention;

Fig. 2 is a cross sectional view through another embodiment of a heat exchange unit incorporating features of this invention, and

Fig. 3 is a side elevation of the unit of Fig. 2.

Referring first to Fig. 1, the heat exchange unit there illustrated has the lower wall 5, the opposite side walls 6 and the upper wall 7. One of the side walls 6 has a recirculated air inlet opening 8 in its lower portion, and the upper wall 7 contains the discharge outlet 9.

The elongated heat exchange tube 10 forms with the sheet member 11, a converging, upwardly extending, ejector nozzle. The vertical walls 12 connect with the lower ends of the tube 10 and the member 11 and together with the lower wall 13 form a primary air passage which connects through one end wall of the unit, with the primary air duct 14.

The duct 14 is adapted to be connected to a central source of primary, conditioned air under sufficient pressure for the ejector nozzle formed by the tube 10 and the member 11 to induce desired volumes of recirculated air through the inlet 8 and for the mixed primary and recirculated air to be discharged at sufficient velocity and under sufficient pressure to convey the discharged air to points in the space served, remote from the unit.

A plurality of closely spaced extended surface fins 15 extend from the surface of the tube 10 opposite the member 11, to one of the vertical walls 6 of the unit. A pivoted damper 16 is provided at the lower end of the tube 10 and is adjustable to open up or to close the recirculated air passage from the inlet 88 through the fins 15.

A second pivoted damper 17 extends between the wall 12 contacting the lower end of the member 11, and the other wall 6 of the unit and is adjustable to close off or open up the recirculated air passage on which it is mounted. This recirculated air passage is seen to be a passage bypassing the heat exchange surfaces formed by the tube 10 and the fins 15.

The dampers 16 and 17 are pivoted in the end walls of the unit and supported thereby by means well known in the art.

The tube 10 has an internal opening 18 for the passage of a heat exchange medium for tempering the primary and recirculated air. In hot weather, a chilled brine or other suitable fluid may be passed through the tube 10 for cooling the air. In cold weather, steam or hot water may be passed through the tube 10 for heating the air.

The lower end of the member 11 is pivoted at 19 and the rod 20 adjustable by the knob 21 serves to vary by manual adjustment the spacing between the nozzle walls and accordingly, the air inducing effect of the nozzle.

In operation, the nozzle spacing is adjusted for proper operation depending upon the static pressure in the primary air, and duct resistance, etc., and is not again adjusted unless conditions change. The dampers 16 and 17 are adjusted for varying the volume of recirculated air which passes in contact with the heat exchange surfaces 10 and 15 and for varying the volume of bypass air, it being preferred that the total discharge volume remain constant throughout the entire range of adjustment. By varying the proportion of heated recirculated air to bypass recirculated air local heat requirements can be satisfied with-

out adjustment of the primary air supply or the heat exchange fluid supply.

The unit of Fig. 2 is similar to that of Fig. 1 in many respects and the same reference characters are applied to similar components. However, instead of having a sheet metal member forming one wall of the ejector nozzle, in Fig. 2, two similar tubes 10 provide the opposite, converging walls of the ejector nozzle, both tubes 10 being provided with the fins 15 which extend from the outer surfaces of the tubes to the walls 6. In the unit of Fig. 2 all of the recirculated air from the inlet 8 passes in contact with the fins 15.

A bypass around the heat exchange surfaces, for recirculated air is provided by another recirculated air inlet 22 placed between the tubes 10 and the air outlet 9. The inlet 8 contains the shutter type dampers 23 and the inlet 22 contains the similar dampers 24. The dampers 23 and 24 are interconnected by the rod 25 and are simultaneously adjusted by the knob 26. The dampers 23 are opened when the dampers 24 are closed and vice versa so that as the volume of bypass air through the inlet 22 is increased, the volume of recirculated air through the inlet 23 is decreased. The deflector 32 prevents the outward flow of air through the inlet 22.

The ejector nozzle adjustment in the unit of Fig. 2 is taken care of by attaching the stationary plate extension 27 to the upper end of one of the tubes 10 and by pivoting the plate extension 28 to the upper end of the other of the tubes. The rod 29 is attached to the plate 28 and is moved by the knob 30 for varying the space between the plates 27 and 28 and accordingly the air inducing effect of the nozzle. The subject matter of Fig. 2 is claimed in applicant's copending divisional application, Serial No. 471,048.

The pipe 31 illustrated by Fig. 3, may be a pipe for conveying heat exchange fluid to the tubes 10.

A side elevation of Fig. 1 would be similar to Fig. 3 except, of course, that the upper recirculated air inlet 22 would be omitted, the knob 30 would be omitted and the lower inlet 8 would appear larger.

Advantages of utilizing the surface of an elongated tube 10 as an ejector wall are that saving in material results; that improved heat transfer is obtained due to the absence of the turbulence and the shadow effect of round tubes; the operation is quieter, the efficiency is greater and the elongated tubes and their fins may be cast iron, a material more easy to obtain than copper under emergency conditions.

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 arrangements of apparatus illustrated, as modifications therefrom may be suggested by those skilled in the art without departure from the essence of the invention.

What is claimed is:

1. A heat exchange unit having a primary air inlet, a recirculated air inlet and a discharge outlet for the mixed primary and recirculated air, an elongated heat exchange tube forming one wall of an ejector nozzle for inducing the flow of air through said recirculated air inlet, said tube having an internal opening for the passage of a heat exchange medium, a member arranged alongside said surface and spaced therefrom and forming the other wall of said nozzle, said member being pivoted at its end opposite the tip of the nozzle for varying the spacing between the nozzle tips and thus varying the induction effect, and means forming a passage conducting air from said primary air inlet into said nozzle and forming walls isolating air from said recirculated air inlet from the air from said primary air inlet.

2. A heat exchange unit having a primary air inlet, a recirculated air inlet and a discharge outlet for the mixed primary and recirculated air, an elongated heat exchange tube forming one wall of an ejector nozzle for inducing the flow of air through said recirculated air inlet, said tube having an internal opening for the passage of a heat exchange medium, a member of sheet material arranged alongside said surface and spaced therefrom and forming the other wall of said nozzle, said member being pivoted at its end opposite the tip of the nozzle for varying the spacing between the nozzle tips and thus varying the induction effect, and means forming a passage conducting air from said primary air inlet into said nozzle and forming walls isolating air from said recirculated air inlet from the air from said primary air inlet.

3. A heat exchange unit having a primary air inlet, a recirculated air inlet and a discharge outlet for the mixed primary and recirculated air, an elongated heat exchange tube forming one wall of an ejector nozzle for inducing the flow of air through said recirculated air inlet, said tube having an internal opening for the passage of a heat exchange medium, a member of sheet material arranged alongside said surface and spaced therefrom and forming the other wall of said nozzle, said member being pivoted at its end opposite the tip of the nozzle for varying the spacing between the nozzle tips and thus varying the induction effect, and means forming a passage conducting air from said primary air inlet into said nozzle and forming walls isolating air from said recirculated air inlet from the air from said primary air inlet, said recirculated air inlet being contained within one wall of said unit and said member being spaced from the opposite wall thereof and providing a by-pass therebetween for air from said recirculated air inlet to said outlet, around said tube.

4. A heat exchange unit having a primary air inlet, a recirculated air inlet and a discharge outlet for the mixed primary and recirculated air, an elongated heat exchange tube forming one wall of an ejector nozzle for inducing the flow of air through said recirculated air inlet, said tube having an internal opening for the passage of a heat exchange medium, a member of sheet material arranged alongside said surface and spaced therefrom and forming the other wall of said nozzle, said member being pivoted at its end opposite the tip of the nozzle for varying the spacing between the nozzle tips and thus varying the induction effect, and means forming a passage conducting air from said primary air inlet into said nozzle and forming walls isolating air from said recirculated air inlet from the air from said primary air inlet, said tube having extended surface fins extending from its external surface opposite to the surface forming an ejector nozzle wall, to one of the walls of said unit, said recirculated air inlet being contained within said wall, said member being spaced from the opposite wall of said unit and providing a by-pass therebetween for air from said recirculated air inlet to said outlet, around said tube and said fins.

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