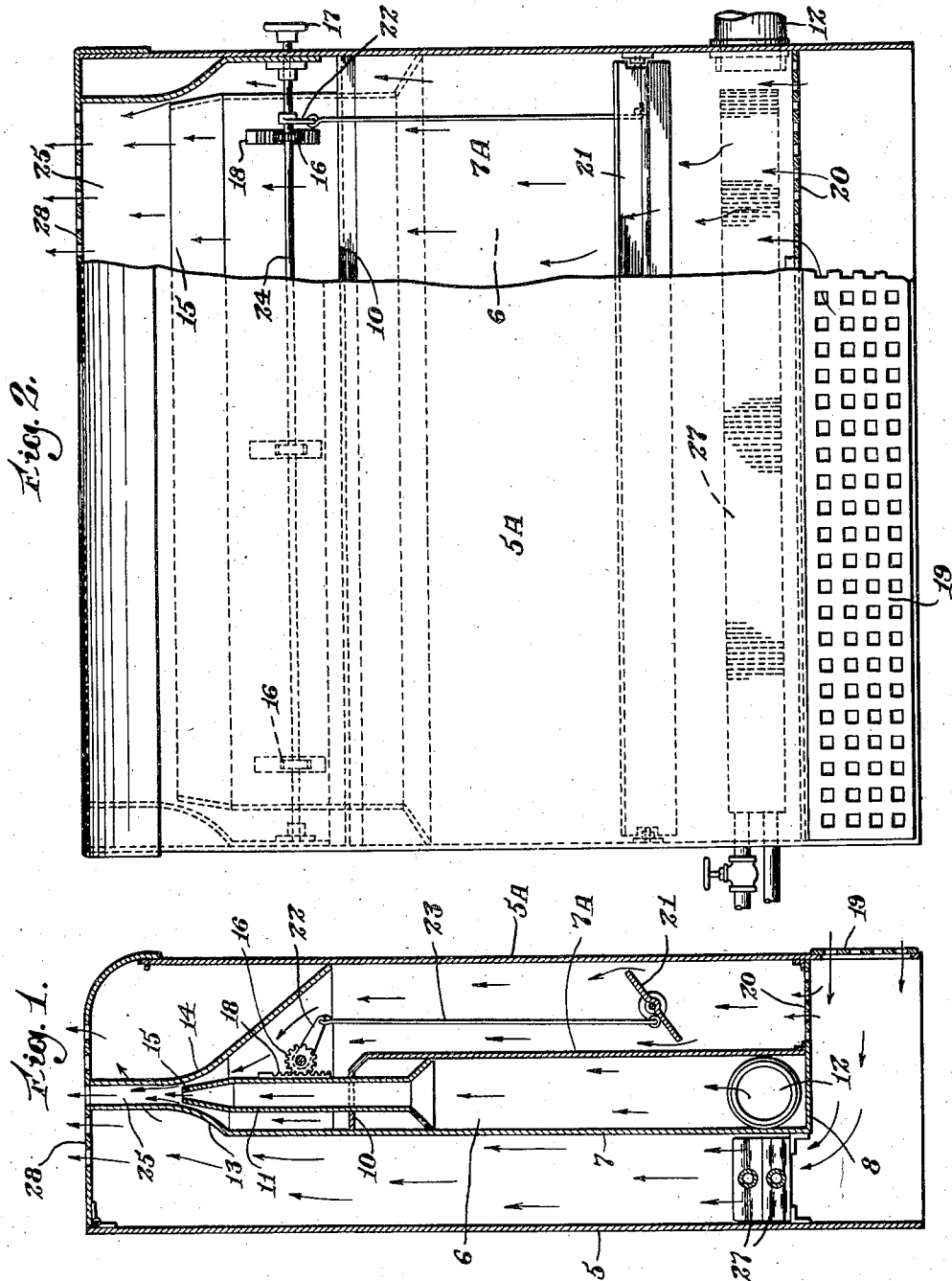


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HEAT EXCHANGE UNIT
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HEAT EXCHANGE UNIT

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This invention relates to methods and apparatus for the conditioning of air and relates more particularly to a heat exchange unit adapted to be supplied with conditioned air from a central source and to distribute the conditioned air, mixed with recirculated air at local distribution points.

In office buildings, hotels and the like, where it is desirable to supply a number of small rooms with conditioned air from a central source, it has been the practice to use what are known as local recirculation units in each room, which receive the conditioned air, mix it with recirculated air drawn in from the room and discharge the mixed air into the room. Since the conditioned air is supplied from the central source under pressure, it has been customary to pass the conditioned air through injectors in the units to induce the flow of recirculated air, thus avoiding the necessity for a fan and driving motor in each unit.

Such units, in the past, have not been completely satisfactory because of the fact that the mixed recirculated and conditioned air was not discharged from the unit at sufficiently high velocity to obtain the correct distribution of the conditioned air within the space to be served; this probably because the injector air and recirculated air was permitted to expand in a diverging space between the injector and the discharge outlet. Another disadvantage of such units has been that it has been difficult to properly adjust their controls in each room to obtain desired temperatures.

According to this invention, a local recirculation unit employs an injector through which conditioned air is discharged to induce the flow of recirculated air. The conditioned air discharges into a restricted opening which extends all the way to the discharge outlet in the unit, into which is also drawn the induced flow of recirculated air so that the mixed air is discharged in a concentrated jet which carries the mixed air to a considerable height above the unit with the result that in hot weather, the cold conditioned air may be carried in convection currents for substantially equal distribution throughout each room.

Other features of the present invention reside in an injector, the lips of which are not adjusted with respect to each other, as has been the practice in the past, to afford control of the inducing of flow of recirculated air, but on the contrary, the injector nozzle is moved in and out of an opening with converging walls to change the effect of the injector upon the air drawn in

by its action. The injector, in its adjustment, is caused to vary the position of a damper in the recirculated air passage, to decrease the amount of recirculated air available when the effect of the injector upon the recirculated air is reduced and to make available an increased amount of recirculated air as the injector is adjusted to be more effective for inducing the flow of recirculated air. Thus the effect of the injector upon the drawing in of recirculated air is magnified through simultaneous adjustment of injector action, and of restrictions in the flow of recirculated air to be acted upon by the injector. This is desirable because the recirculated air is drawn into the unit chiefly for the purpose of tempering with warm air from the room, the intensively conditioned air usually supplied by the central source.

An object of the invention is to project conditioned air from a local recirculation unit to a substantial height above said unit.

Another object of the invention is to provide in a local recirculation unit, an injector supplied with conditioned air from a central source for inducing the flow of recirculated air; the mixed air being discharged from the unit at high velocity.

Another object of the invention is to control the effect of an injector in a local recirculation unit by varying the position of the injector nozzle with respect to the converging walls of a space into which it discharges.

Another object of the invention is to simultaneously adjust through a single control, the effect of an injector for inducing the flow of recirculated air into a unit, and the quantity of recirculated air available to be acted upon by the injector.

Other objects of the invention will be apparent from the following description taken together with the drawing.

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

Fig. 1 is a side sectional view of one embodiment of a local recirculation unit according to this invention, and

Fig. 2 is a side view, with a portion of the cover removed and a portion in dotted outline, of the unit of Fig. 1.

The unit is defined by the outer walls 5 and 5A which may be of metal or any other suitable material. Supported within the unit is the compartment 6 into which is supplied through the duct 12, conditioned air from a central source (not shown). The compartment is defined by the two vertical walls 7 and 7A, the lower horizontal wall 8 and the upper wall 10, which, how-

ever, contains an opening for receiving the injector nozzle 11.

The upper portion of the wall 7 is curved at 13 to provide, with the oppositely placed curved wall 14, a restricted passage with converging walls into which the tip 15 of the injector nozzle 11, discharges. The nozzle 11 is adapted to be moved up and down by movement of the gear 16 operated by the control knob 17, the gears 16, meshing with the teeth of the rack 18, with the result as the control knob 17 is rotated, the tip 15 of the nozzle moves nearer to or further away from the converging walls 13 and 14 to increase or decrease, respectively, the effect of the injector action.

In the lower portion of the vertical wall 5A is provided the grille 19 for the passage into the unit, of recirculated air. The horizontally placed grille 20 permits a portion of recirculated air to pass into the recirculated air passage between the walls 5A and 7A. The damper 21 is provided in this passage to variably restrict the passage, under control of the control knob 17. This is accomplished by the connection of the damper 21 to the lever 22 by means of the connecting arm 23. The lever 22 is connected to the shaft 24 which is rotated by the knob 17 and to which the gear 16 is fixedly attached.

As conditioned air from the central source passes under substantial pressure through the duct 12 into the compartment 6, it discharges through the restricted opening in the tip 15 of the nozzle 11 at high velocity. The high velocity air discharging from the nozzle into the space between the converging walls 13 and 14 causes the inducing of recirculated air through the grilles 19 and 20. The conditioned air and recirculated air is mixed above the tip 15 of the nozzle and is discharged through the narrow slot 25 which extends all the way to the top of the unit. According to an important feature of this invention, the slot 25 is unconfined at its upper portion. Thus no back pressure is created by presence of any portion of the ordinary discharge grille with the result that the air passes at high velocity from the upper portion of the unit and completely to the ceiling of the room in which the unit is placed.

The main reason for the inducing of recirculated air into a local recirculation air unit of this character is to permit, in summer, warm air from the room to increase the temperature of the cold air supplied from the central source. Air movement is not important since return air ducts from each room exhaust air from the room which is ordinarily carried back to the central source of conditioned air to be reconditioned. Thus the exhaust of this air provides the necessary air movement.

By adjusting the effect of the injector, more or less recirculated air may be indrawn to warm more or less respectively the air passing through the unit. Thus, in the ordinary unit, when the room becomes too cold the injector is adjusted to induce the flow of more recirculated air for tempering purposes; likewise when the room becomes too warm the injector is adjusted so that less recirculated air is drawn into the unit.

According to this invention, the tempering effect of recirculated air is made use of to great advantage by controlling simultaneously the effect of the injector upon the recirculated air and the amount of recirculated air available for action thereon by the injector.

Likewise when the air within the room be-

comes too cold and more recirculated air is required for tempering purposes, the knob 17 is manipulated to move the injector nozzle 11 nearer the converging walls 13 and 14 for increasing the injector effect and simultaneously the damper 21 is adjusted to facilitate the flow of recirculated air to be acted upon by the injector.

The two simultaneously operated controls for providing recirculated air for tempering purposes were found desirable because either control taken alone did not provide the desired effect. Heretofore, in units of this type, the sole control of the flow of recirculated air for tempering purposes was provided by adjusting the space between the lips of an injector. Due to the inefficiencies of injector arrangements, this adjustment had too little effect upon the inducing of recirculated air. Accordingly in prior units it was customary to pass the recirculated air through a heater which was operated to add heat to the recirculated air when the temperature within a room became too cold.

The injector adjustment and the temperature adjustment may be, of course, separately controlled but it is preferred, for convenience of adjustment, that they be simultaneously adjusted.

Since the unit, according to this invention, is a universal one for supplying cooled air in summer, and heated air in winter, the heating coils 27 are provided in the space between the vertical walls 5 and 7. When the steam or any other suitable heating medium is supplied to the coil 27, recirculated air is drawn in through the grille 19, in convection currents and is heated and discharged from a discharge grille 28, through openings on both sides of the slot 25, through which cool air is supplied in summer. Under unusual conditions the heating coil 27, could of course be used in summer to supply heated air to the room for tempering purposes simultaneously with the supply through the slot 25 of cold air. Such conditions may occur as when, due to a sudden drop in outdoor temperature, the operation of the central conditioning plant has not been correctly adjusted.

Whereas, one embodiment of the invention has been disclosed for the purpose of illustration, it should be understood that the invention is not limited to the exact arrangement disclosed as many departures may be made by those skilled in the art, after having had access to this disclosure.

What is claimed is:

1. Heat exchange apparatus comprising a casing, means for admitting recirculated air from the space served by said apparatus into said casing, means for admitting conditioned air into said casing, an injector within said casing so arranged with respect to said means as to convert the pressure energy of the conditioned air into velocity energy and to induce the flow of recirculated air into said casing, means forming a converging space into which said injector discharges, and means for moving said injector into and out of said converging space for increasing and decreasing respectively, the effect of said injector upon the induced flow of recirculated air.

2. Heat exchange apparatus comprising a casing, means for admitting recirculated air from the space served by said apparatus into said casing, means for admitting conditioned air into said casing, an injector within said casing so arranged with respect to said means as to convert the pressure energy of the conditioned air into velocity energy and to induce the flow of recirculated air

into said casing, converging walls within said casing between which said injector discharges, and means for moving said injector into and out of the converging space between said walls for increasing and decreasing respectively, the effect of said injector upon the induced flow of recirculated air.

3. Heat exchange apparatus comprising a casing, means for admitting recirculated air from the space served by said apparatus into said casing, means for conducting conditioned air into said casing, an injector within said casing so arranged as to convert the pressure energy of the conditioned air into velocity energy so as to induce the flow of recirculated air into said casing, means for varying the effect of said injector upon the induced flow of recirculated air, and means for varying the quantity of recirculated air to be acted upon by said injector to increase the quantity of recirculated air when said injector is adjusted to be more effective upon same and to decrease the quantity of recirculated air when the injector is adjusted to be less effective upon same.

4. Heat exchange apparatus comprising a casing, an injector in said casing, means for supplying recirculated air from the space served by said apparatus into said casing, means for supplying a portion of the recirculated air supplied by said means past the tip of said injector, means for supplying conditioned air through said injector to induce the flow of recirculated air past its tip, means forming a converging space into which said injector discharges and a narrow passage extending to an outlet in said casing through which the mixed conditioned and recirculated air is discharged from said casing in a concentrated jet, a heater in said casing, means for passing another portion of the recirculated air supplied by said first mentioned means in contact with said heater, and means for discharging the heated recirculated air from said casing in a path exterior of said passage but in injector relationship to said passage, whereby the flow of mixed conditioned

and recirculated air through said passage induces the flow of recirculated air in contact with said heater.

5. Heat exchange apparatus comprising a casing, an injector in said casing, means for supplying recirculated air from the space served by said apparatus, into said casing past the tip of said injector, means for supplying conditioned air through said injector to induce the flow of recirculated air, a discharge outlet in the upper portion of said casing, means forming a converging space into which said injector discharges and a relatively narrow slot extending to said outlet through which the mixed conditioned and recirculated air is discharged from said casing in a concentrated jet, a second discharge outlet in the upper portion of said casing adjacent said first mentioned discharge outlet, means for supplying other recirculated air from the space served, through said casing and to said second outlet in a path exterior of but adjacent to said slot, whereby the air discharged from said first mentioned outlet induces the flow of said other recirculated air through said casing.

6. Heat exchange apparatus comprising a casing, an injector in said casing, means for supplying recirculated air from the space served by said apparatus, into said casing past the tip of said injector, means for supplying conditioned air through said injector to induce the flow of recirculated air, means forming a converging space into which said injector discharges and a relatively narrow slot through which the mixed conditioned and recirculated air is discharged in a concentrated jet, means for supplying other recirculated air from the space served, through said casing in a path exterior of but adjacent to said slot, whereby the air discharged from said slot induces the flow of said other recirculated air through said casing, and means in the upper portion of said casing for the discharge therefrom of the air passing therethrough.

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