March 26, 1935. V. CANO 1,995,667

AIR CONDITIONING APPARATUS

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Fig. 2

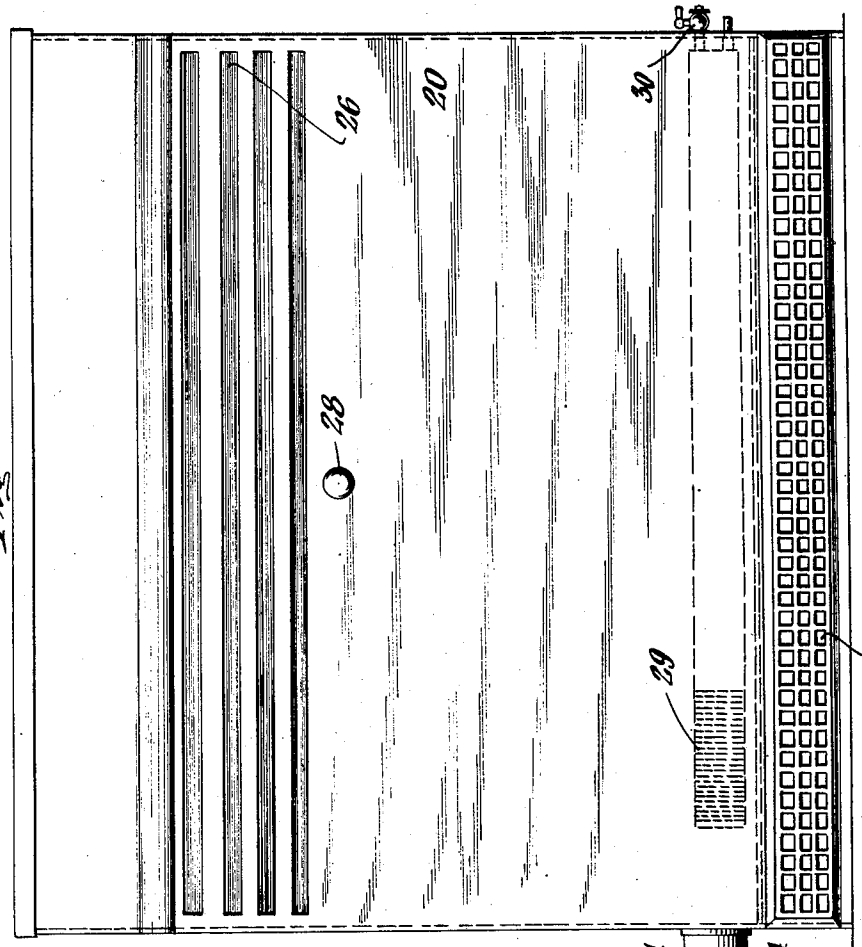


Fig. 1

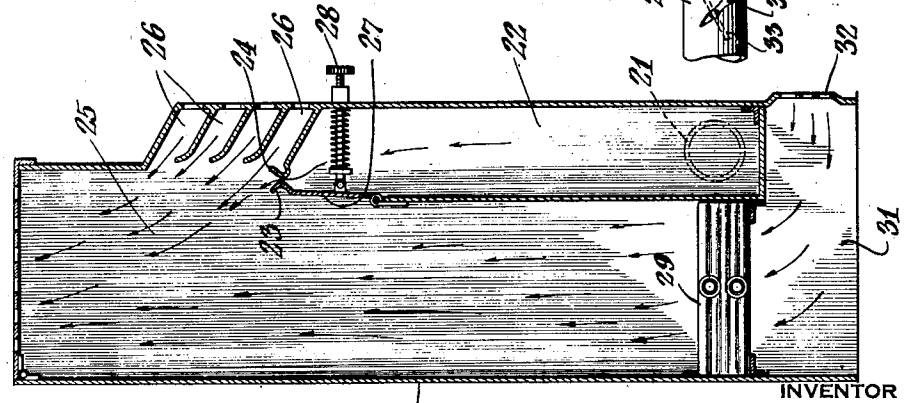


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Fig. 3

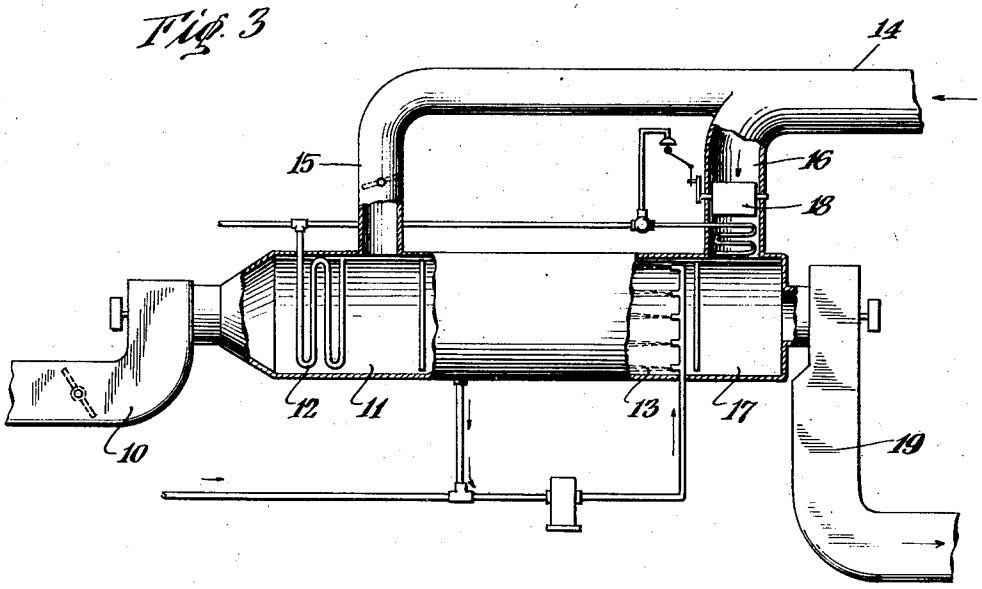
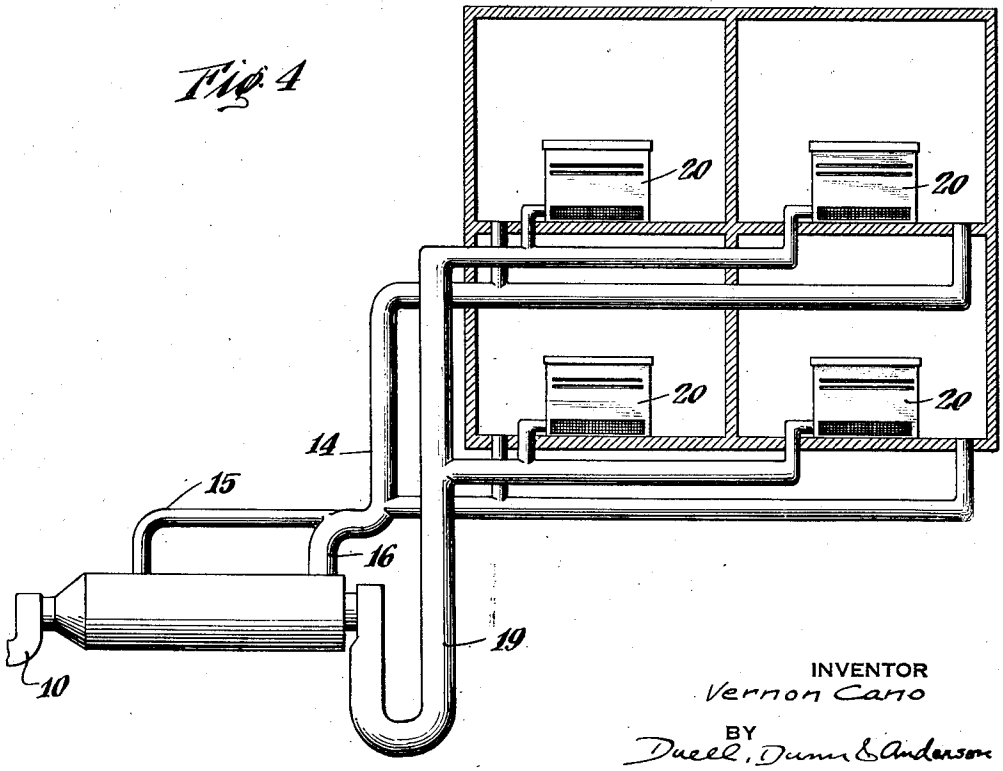



Fig. 4

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Patented Mar. 26, 1935 1,995,667

# UNITED STATES PATENT OFFICE

1,995,667

## AIR CONDITIONING APPARATUS

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Application March 1, 1932, Serial No. 595,988

8 Claims. (Cl. 98—38)

This invention relates to apparatus for conditioning air and relates more particularly to an air conditioning system having a central conditioning unit and a plurality of spaced distribution units.

To maintain comfort conditions in enclosures where people are accustomed to assemble, there are a number of things to be considered. In summer the air ordinarily needs to be dehumidified and cooled; in winter the air supplied ordinarily has to be heated and moisture added to it. It is desirable also that no unpleasant drafts be produced by the supply of the conditioned air to the enclosure and it is further desirable that the distribution unit be provided with controls in order that the output of the unit may be adjusted to provide a supply of air which is most comfortable to the people adjacent its immediate location.

An object of this invention is to supply cool and dehumidified air in summer and warm and humidified air in winter.

Another object of the invention is to supply conditioned air from a central unit to remote distribution units.

Another object of the invention is to provide an improved distribution unit.

Another object of the invention is to provide an efficient distribution unit, the output of which may be controlled as desired.

Another object of the invention is to provide, in an air conditioning system having a central supply unit and a plurality of distribution units, controls for compensating for the varying distance the individual units may be from the central supply.

According to this invention, a central air conditioning unit, which serves to clean and adjust the moisture and heat content of outside air, supplies conditioned air to a plurality of local distribution units located at advantageous points throughout a building. Since, after the system has been in operation for a given period of time, the air within the building is ordinarily nearer the desired conditions to be maintained than the outside air, a portion of it is recirculated through the conditioning unit to be mixed with outside air and conditioned, and a portion is mixed with the conditioned air prior to its discharge from the conditioning unit. The conditioned air is supplied to distribution units, each of which are capable of adjustment to enable control of its output to provide a supply of air having characteristics which are most pleasing to the person or persons in the room for which it is provided. The local distribution units withdraw air from the rooms in which they are placed and recirculate this air and mix it with the conditioned air supplied. This insures circulation of the air throughout the rooms and also enables a system to be provided in which a smaller amount of conditioned air can be supplied to the units, since the air within the rooms, after a period of time, has very nearly the desired characteristics so that only a small amount of fresh air need to be supplied to maintain comfort. Each of the distribution units is provided with controls for varying the amount of fresh air supplied and for varying the temperature of a heating unit mounted in each distribution unit.

Air from the room in which a distribution unit, according to this invention, is mounted is drawn into the unit and mixed with conditioned air by induction; that is to say, the flow of conditioned air through the unit induces the flow of air from the room into the unit. The amount of air drawn from the room into the unit depends upon the rate of flow of the conditioned air supplied and this, in turn, depends upon the distance the distribution unit is from the central supply unit. According to a feature of this invention, means are provided at each distribution unit for adjusting the rate of flow of the conditioned air supplied to each unit so as to insure that the same amount of air is recirculated by each individual distribution unit.

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

Fig. 1 is an end view with the end removed of a local distribution unit, according to this invention;

Fig. 2 is a side view of the unit of Fig. 1;

Fig. 3 is a diagrammatic view of a central air conditioning unit which may be used with the distribution units of this invention, and

Fig. 4 is a diagrammatic view of a complete air conditioning system, according to this invention, showing a central supply unit and a plurality of remote distribution units.

A central air conditioning unit shown by Fig. 3 is of the type described in Patent #1,670,656, issued May 22, 1928, to Walter L. Fleisher, and its operation is explained in detail in that patent. Accordingly, only brief mention of its operation will be made here. Referring now to Fig. 3, outside air enters through the duct 10, passes into the mixing chamber 11, where it may be heated by the steam coils 12, then passes into the spray chamber 13 where its moisture content and temperature are regulated. Recirculated air

from the enclosure enters the duct 14, a portion passes through the duct 15 into the mixing chamber 11, and another portion passes through the duct 16 into a mixing chamber 17. The ratio of the air from the enclosure entering chamber 17 to that entering chamber 11 is controlled thermostatically by means of the damper 18. The conditioned air is supplied to the various local distribution units through the main supply duct 19. As fully explained in the patent, this type of air conditioning unit acts automatically to control the moisture content and temperature of the air supplied to the system automatically, regardless of weather changes. In summer the air is dehumidified and cooled; in winter the air is heated and humidified.

Figure 4 illustrates diagrammatically a complete system utilizing the central air conditioning unit of Fig. 3, supplying conditioned air through the duct 19 to a plurality of local distribution units 20. Air from the building is circulated back to the conditioning unit through the recirculation duct 14.

An embodiment of the local distribution units 20 of Fig. 4 will now be described with reference to Figs. 1 and 2. The conditioned air supplied by the main supply duct 19 is fed into the unit 20 through the individual supply duct 21. The air through the supply duct 21 enters into a chamber 22 and passes between the nozzle lips 23 and 24, which extend longitudinally of the unit, into the mixing chamber 25. Above the nozzle lips are located the recirculated air vents 26 through which the flow of air from the room is induced by the passage of conditioned air from the chamber 22 between the nozzle lips 23 and 24 into the mixing chamber 25. The nozzle lip 23 forms the upper portion of a hinged plate 27 and its position relative the nozzle lip 24 is controlled by the adjustment of the thumb screw 28. By adjustment of this thumb screw, the position of the nozzle lips 23 and 24 may be adjusted nearer each other to increase the velocity of the air passing from the chamber 22 into the chamber 25, and by separating the nozzle lips a greater distance, the velocity of the air passing therebetween may be made less. The greater the velocity of the air passing between the nozzle lips, the greater the flow of induced air through the vents 26 and vice versa. Accordingly, the thumb screw may be adjusted to control the amount of air recirculated from the room into each local distribution unit. It is preferred that once a proper adjustment of this thumb screw 28 has been made, it will remain fixed, although, of course, this adjustment may be made to control the supply of conditioned and recirculated air. This control is provided primarily for compensating for the varying distances the local distribution units 20 are separated from the air conditioning supply unit. Naturally, the units nearer the central supply unit receive conditioned air at higher velocity and units further away receive air at lower velocities. By adjusting the nozzle lips 23 and 24 of the most remotely located distribution units 20, the velocity of the air passing therebetween is increased to compensate for the distance of separation of the units from the central supply unit.

The local distribution units 20 are also provided with a steam heater 29, the supply of steam to which is controlled by means of the valve 30. The heater 29 is located as low as is conveniently possible in the unit 20 in order that a high thermal head may be obtained. Below the heating unit 29 is the chamber 31 into which air from the room passes through the grilled inlet 32.

The conditioned air supply duct 21 contains a damper 33, the position of which is adjusted by means of the damper lever 34. When the temperature within the room, where one of the local distribution units is located, is thought to be too high, the steam valve 30 may be closed and the conditioned air damper 33 opened. Then relatively cool, conditioned air passes from the supply duct 21 into the chamber 22, thence between the nozzle lips 23 and 24 into the mixing chamber 25, recirculated air from the room being drawn in through the vents 26. When, on the other hand, the air in the room is thought to be too cool, the damper 33 may be closed and the steam valve 30 opened. Then the heating unit 29 heats the air in its vicinity, inducing the flow of recirculated air through the grille 32, the recirculated air being heated by the heater 29.

In various local distribution units which have been provided in the past, it has been the practice to locate the heating coils in a single recirculation passage. The disadvantages of such practices have been that the restricted passage caused by the heating surfaces offers high resistance to the flow of recirculated air so that adequate recirculation could not be obtained. It is seen that, according to this invention, separate recirculation inlets are provided for the air which is to be heated or passes in contact with the heater surfaces and for the air which is to be supplied when the heater is out of operation. Accordingly, efficient recirculation is obtained and adequate control is provided. By various adjustments of the conditioned air dampers 33 and the steam valve 30, the heat can be completely shut off, only cooled, conditioned air mixed with recirculated air and supplied to the room; the supply of conditioned air can be shut off by the closing of the damper 33, the air within the room heated by the action of the heating unit 29, or the damper 33 may be partially opened and the steam valve 30 partially opened to supply cool, conditioned air to the room, the cooled air being tempered by the action of the heating unit 29.

Whereas one embodiment of the invention has been described for the purpose of illustration, it should be understood that the invention is not limited to the exact details described since many departures may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. A distribution unit for air conditioning systems comprising a conditioned air passage, a heated air passage, a partition separating said passages and forming a common side thereof, the side walls of said unit forming the other sides of said passages, a member extending into said conditioned air passage and forming one lip of a nozzle and extending the length of said unit, another member hinged to the top of said partition forming the other lip of the nozzle extending longitudinally of said unit, the air from said conditioned air passage being discharged through the restricted passage between said nozzle lips, a recirculated air passage above and in close proximity to said nozzle lips, whereby the passage of conditioned air therethrough induces the flow of recirculated air, and a heating unit in the base of said heated air passage.

2. A distribution unit for air conditioning systems comprising a conditioned air passage, a

heated air passage, a partition separating said passages and forming a common side thereof, the side walls of said unit forming the other sides of said passages, a member extending into said conditioned air passage and forming one lip of a nozzle and extending the length of said unit, another member hinged to the top of said partition forming the other lip of the nozzles extending longitudinally of said unit, the air from said conditioned air passage being discharged through the restricted passage between said nozzle lips, a recirculated air passage above and in close proximity to said nozzle lips, whereby the passage of conditioned air therethrough induces the flow of recirculated air, a heating unit in the base of said heated air passage, and another recirculated air passage in the base of said distribution unit and connected with said heated air passage through openings in said heating unit.

3. Air conditioning apparatus comprising an upright enclosure adapted to be mounted in the room being served with conditioned air, said enclosure having a discharge outlet in the upper portion thereof, a conditioned air inlet in the lower portion thereof, a recirculated air inlet, a partition in said enclosure forming with the sides thereof a recirculated air passage and a conditioned air passage connecting with said recirculated air inlet and conditioned air inlet respectively, the conditioned air passage terminating below said outlet and having a restricted discharge for increasing the velocity of conditioned air discharged therefrom, a second recirculated air inlet located adjacent the discharge of said conditioned air passage, the flow of air through said second recirculated air inlet being induced by the flow of conditioned air, and angular deflecting members in said second recirculated air inlet and arranged adjacent the restricted discharge in said conditioned air passage and between said restricted discharge and said outlet for deflecting the air drawn therein in an upward direction towards said outlet and in injector relationship over the upper end of the restricted discharge in said conditioned air passage.

4. Air conditioning apparatus comprising an upright enclosure adapted to be mounted in the room being served with conditioned air, said enclosure having a discharge outlet in the upper portion thereof, a conditioned air inlet in the lower portion thereof, a recirculated air inlet, a partition in said enclosure forming with the sides thereof a recirculated air passage and a conditioned air passage connecting with said recirculated air inlet and conditioned air inlet respectively, the conditioned air passage terminating below said outlet and having a restricted discharge for increasing the velocity of conditioned air discharge therefrom, a heater in said recirculated air passage, a second recirculated air inlet located adjacent the discharge of said conditioned air passage, the flow of air through said second recirculated air inlet being induced by the flow of conditioned air, and angular deflecting members in said second recirculated air inlet and arranged adjacent the restricted discharge in said conditioned air passage and between said restricted discharge and said outlet for deflecting the air drawn therein in an upward direction towards said outlet and in injector relationship over the upper end of the restricted discharge in said conditioned air passage.

5. Air conditioning apparatus comprising an upright enclosure adapted to be mounted in the room being served with conditioned air, said enclosure having a discharge outlet in the upper portion thereof, a conditioned air inlet in the lower portion thereof, a recirculated air inlet, a partition in said enclosure forming with the sides thereof a recirculated air passage and a conditioned air passage connecting with said recirculated air inlet and conditioned air inlet respectively, the conditioned air passage terminating below said outlet and having a restricted discharge for increasing the velocity of conditioned air discharged therefrom, a second recirculated air inlet located adjacent the discharge of said conditioned air passage, the flow of air through said second recirculated air inlet being induced by the flow of conditioned air, and angular deflecting members in said second recirculated air inlet for deflecting the air drawn therein in an upward direction, the lowermost of which forms a part of the restricted discharge for said conditioned air passage.

6. Air conditioning apparatus comprising an upright enclosure adapted to be mounted in the room being served with conditioned air, said enclosure having a discharge outlet in the upper portion thereof, a conditioned air inlet in the lower portion thereof, a recirculated air inlet, a partition in said enclosure forming with the sides thereof a recirculated air passage and a conditioned air passage connecting with said recirculated air inlet and conditioned air inlet respectively, the conditioned air passage terminating below said outlet and having a restricted discharge for increasing the velocity of conditioned air discharged therefrom, a heater in said recirculated air passage, a second recirculated air inlet located adjacent the discharge of said conditioned air passage, the flow of air through said second recirculated air inlet being induced by the flow of conditioned air, and angular deflecting members in said second recirculated air inlet for deflecting the air drawn therein in an upward direction, the lowermost of which forms a part of the restricted discharge for said conditioned air passage.

7. A local recirculation unit for air conditioning systems comprising a cold air supply passage terminating in an upwardly directed injector nozzle, a discharge outlet in the upper portion of said unit above said nozzle, a recirculated air inlet between said nozzle and said outlet, and angular deflecting members associated with said nozzle and said inlet for directing the recirculated air in injector relationship above and across the tip of said nozzle.

8. A local recirculation unit for air conditioning systems comprising a cold air supply passage terminating in an injector nozzle, a discharge outlet in the upper portion of said unit above said nozzle, a recirculated air inlet between said nozzle and said outlet, and upwardly directed angular deflecting members associated with said nozzle and said inlet for directing the recirculated air in injector relationship above and across the tip of said nozzle and upwardly towards said outlet.

VERNON CANO.