

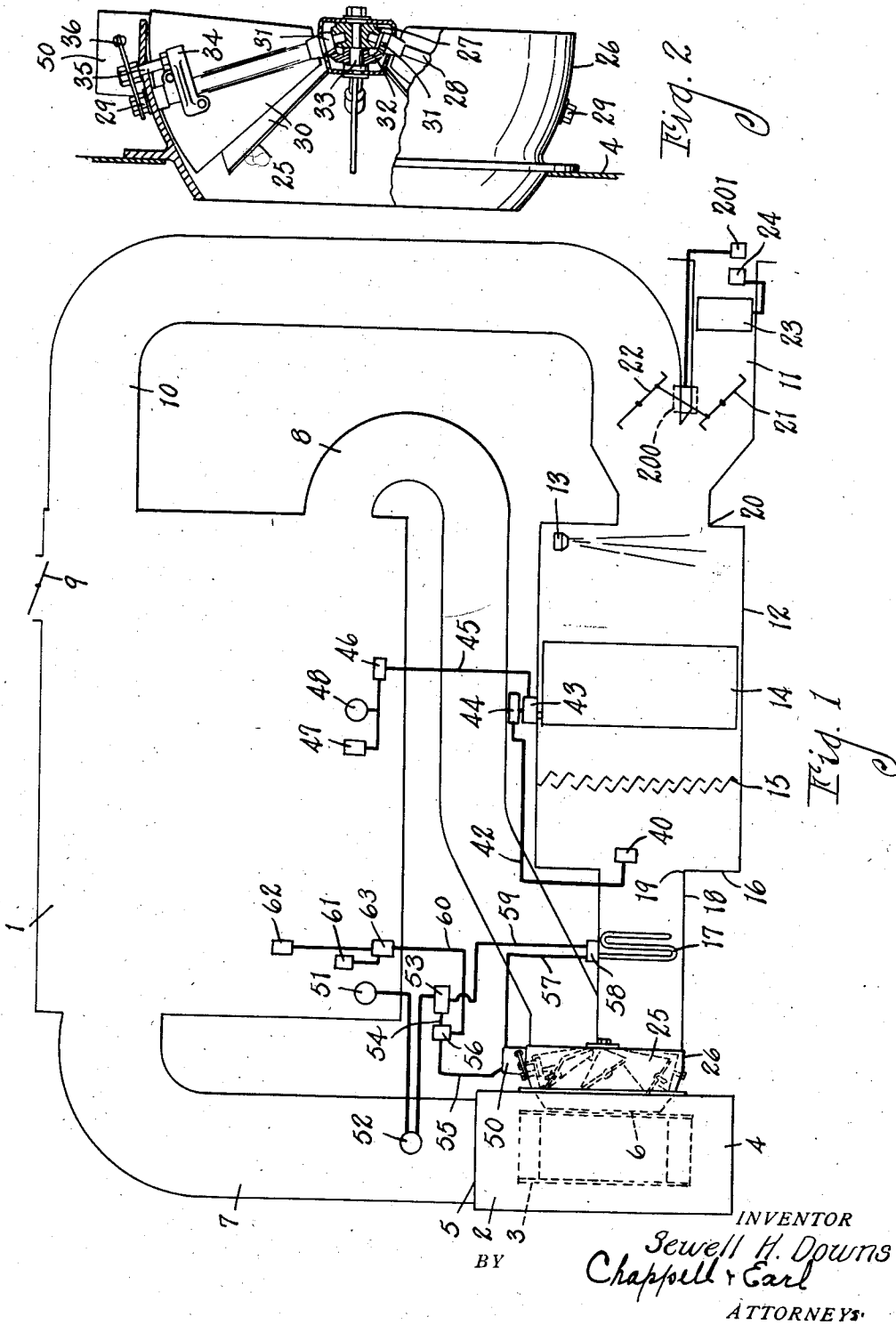
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CONDITIONING SYSTEM

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CONDITIONING SYSTEM

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7 Claims. (Cl. 257—8)

The objects of this invention are:

First, to provide a system and method of conditioning and ventilating a room in which the conditioned air that is sent to the room does not differ so greatly from the air in the room so as to be uncomfortable and in which the heat from the air in the room is utilized in conditioning the air sent to the room providing for great economy of operation.

Second, to provide such a system in which only a portion of the air is conditioned and is mixed with re-circulated air to maintain proper conditions within the room with the attendant economy in size of conditioning equipment.

Third, to provide such a system in which the conditioned and re-circulated air are mixed in constant proportions while the condition of the portion of the air that is conditioned is determined on room conditions.

Fourth, to provide such a system in which the conditioned and re-circulated air are mixed in constant proportions and the condition of the room is maintained through varying the amount of the mixture that is admitted to the room with the attendant saving on complicated damper equipment.

Fifth, to provide such a system in which a constant speed centrifugal fan is used with a new vortex control means, whereby the amount of air admitted to the room is effectively conditioned by one control with a great saving of power on the fan when it is operating at a capacity below its full capacity.

Sixth, to provide a method of conditioning the air in a room which method can be carried out simply and cheaply and with a minimum of equipment.

Other objects and advantages of construction and operation will appear from the detailed description to follow. A preferred embodiment of my invention appears in the accompanying drawing, in which:

Fig. 1 is a diagrammatic representation of a system embodying the features of my invention.

Fig. 2 is a detail view partly in section of the vortex control means.

The parts will be identified by their numerals of reference which are the same in all the views.

1 is the room or auditorium to be ventilated or conditioned. 2 is the centrifugal induction fan having a conventional fan wheel 3 adapted to be rotated in a clockwise direction viewed from the right of the casing 4 thereof as represented in Fig. 1. 5 is the outlet and 6 is the inlet. 7 is a duct leading from the fan outlet 5 to the room. 8 is

a duct for carrying re-circulated air to the inlet 6 of the fan 2. 9 is a damper for relieving air from the room to make room for fresh outside air or air from another source. 10 is a duct for returning air from the room to the inlet of a conditioner. 11 is a duct for the admission of outside air to the inlet of a conditioner. 12 is a conditioner having washing sprays 13, refrigerating element 14, and eliminators 15, all enclosed in the casing 16 as will be fully understood by those skilled in the art.

The refrigerating unit may be of any conventional construction. It may refrigerate the air through cooled sprays or through closed coils in which a refrigerant is circulated, which coils may have a spray thereon or not, as desired. The temperature may be controlled by use of a three-way valve which mixes a cooled refrigerant with refrigerant re-circulated from the coils or sprays, or the control of the refrigerating may be accomplished through controlling the amount of refrigerant circulated or controlling its temperature directly without any re-circulating features. Water from a source of supply such as a city water system may be used if it is cold enough.

A heater 17 is supplied in the duct leading from the conditioner. This heater may be used in summer conditioning or not as desired. The heat for raising the temperature of the air and increasing its sensible heat is usually supplied from re-circulated air in the summer operation and the heating coil will not be necessary.

18 is a duct leading from the conditioner outlet 19 to the inlet 6 of the fan. 20 is the inlet to the conditioner. 21 and 22 are interconnected dampers, 21 being located in the duct for outside unconditioned air, hereinafter called the outside duct, and 22 being located in the return air duct 10. The damper 21 is of a size to completely cut off the fresh or unconditioned air and the damper 22 is of the same size but the duct 10 is illustrated as of such size that the damper 22 will not completely close off the flow of return air when it is in its closed position. This is to provide a certain amount of return air for the conditioner at all times during the operation of the system to bring about economy of operation. The dampers 21 and 22 being of the same size, proportion the amount of fresh or unconditioned air and returned air admitted to the conditioner without in any way varying its volume.

The dampers 21 and 22 may be hand operated or may be operated by a motor 200 under control of thermostat 201 which is positioned outside of the building to operate on the condition of the

air taken in through conduit 11. This thermostat 201 is so arranged that the damper 21 is opened when the temperature outside drops. This is used when the system is used for cooling and taking in cool outside air eliminates the necessity for doing so much cooling in the conditioner.

23 is a heater located in the outside duct for tempering the air and has a thermostat 24 to regulate the temperature so that in winter months the outside air will not cause freezing in the conditioner.

The vortex control means is shown at 25 and comprises an inlet cone 26 adapted to feed air to the inlet of the fan wheel 3. A spider hub 27 is mounted in the center of this cone on spider rods 28 which are held by nuts 29 and are threaded into the spider hub. Substantially sector-shaped blades 30 are journaled on these rods and are adapted when in closed position to completely cut off the flow of air through the cone 26 or the inlet 6 of the fan. When in partially open position these blades 30 are positioned to impart to air entering the fan a swirl in the direction of rotation of the fan wheel.

In operation it has been proven that this method of controlling the vortex of the fan gives a very accurate volume control and makes it possible to use a constant speed fan with great saving of power expended because the swirl imparted to the incoming air eliminates the duty ordinarily placed upon fan blades to which the direction of flow of air before the fan can operate thereon for its usual pumping action. Means are provided for rotating the blades in unison about the spider rods. At the inner end of each blade is a segmental pinion 31 adapted to mesh with a bevel gear 32 that is journaled on the spider hub on a pin 33. The blades are turned in unison by means of a bracket 34 attached to one blade having a crank arm 35 to which is connected a rod 36 connected to a diaphragm motor or other control device. When the one blade is rotated, its pinion rotates the bevel gear and the other blades are rotated to a like position. The device is described in detail in my copending application Serial No. 598,784, filed March 14, 1932, for vortex controls.

The conditions in the room may be controlled by any suitable controls, either compressed air or electric, as desired. I have shown a system of controls diagrammatically and the controls shown are especially adapted for electric operation, although it is possible to maintain the desired conditions through similar controls operated under compressed air. The conditioner may be so arranged that it will discharge air at a constant dew point which may be set by the operator of the room for any given outdoor conditions. This control comprises a dew point thermostat 40 connected by suitable connections 42 to the motor 43 which controls the temperature of the refrigerating element 14 in any of the methods set forth above.

I provide a two-way switch 44 in the connection from the dew point thermostat 40 to the motor 43, the reason for which will be explained.

It may be desirable to control the dew point of the air issuing from the conditioner under conditions in the room. For this I provide a connection 45 from the two-way switch 44 to switch 46 in the room and I provide a wet bulb thermostat 47 and a relative humidity control such as a humidistat 48, both connected to the two way switch 46, so that it is optional whether the con-

trol of the dew point of air leaving the conditioner will be under the wet bulb conditions in the room, or under the relative humidity there. For various conditions of operation and the conditions outside, it may be desirable to use any one of the three controls set forth by me. The vortex control means 25 are operated by a motor 50 which operates under various controls as desired. One system of control for the motor 50 is a dry bulb thermostat 51 located in the room or in the duct 8, as desired. This thermostat for controlling the air is connected in series with a second dry bulb thermostat 52 located in the duct 7 leading from the fan to the room, which, in turn, is connected to a reversing switch 53. The reversing switch may be controlled by outside temperature and is for use in changing the system from summer to winter operation, as will be explained.

From the switch 53 connections 54 and 55 lead to the motor 50. A two-way switch 56 is between the connections 54 and 55, the purpose of which will be explained. Connection 57 runs from the motor 50 to a second motor 58 that controls the temperature in the heating coil 17. The motor 58 may control the temperature in any conventional way. A connection 59 runs from the motor 58 to the reversing switch 53. The switch 53 is so arranged that in summer operation the circuit is from dry bulb thermostat 51 through dry bulb thermostat 52 and the switch 53 to the motor 50.

When the temperature in the room is too high, the thermostat 51, which is the master thermostat, causes the blades of the vortex control 25 to open to admit more cooled air to the room. If the air coming from the room is too cold, the thermostat 52 in the duct 7 will prevent too great an opening of the blades, although the blades will stay open to the widest extent allowed by thermostat 52 until the room has reached the desired degree of coolness.

For winter operation, the reversing switch 53 is thrown so that the connection is from the dry bulb thermostat 51 through the switch 53 to heater motor 58 and to motor 50. In operation, if more heat is needed, the vortex control 25 is opened wide and air is circulated. If the complete circulation does not warm up the room, more heat is put in through the coil 17 under control of the motor 58.

For some operations it may be desirable to control the volume of air admitted under wet bulb conditions in the room or in the re-circulating duct 8. For this reason I provide the two-way switch 56 which is connected by connection 60 to wet bulb thermostat 61 located in the room or in the duct 8, as desired. By throwing the switch 56, the circuit may run from the wet bulb thermostat 61 to the motor 50, so that the motor 50 controls the volume of air passing through the fan 2 under wet bulb conditions in the room. If more heat is needed, the vortex control 25 would be opened wider.

In operation it will be seen that the various combinations of controls can be used to obtain desired results. The constant dew point control for the conditioner can be used in connection with the vortex control under control of dry bulb conditions in the room, or under wet bulb conditions. Likewise the dew point of air leaving the conditioner can be controlled under wet bulb conditions in the room or under relative humidity conditions in the room, as desired, while having the vortex control means under wet or dry bulb conditions in the room. If desired a

humidistat 62 may be connected to be selectively used instead of the wet bulb thermostat 61 by means of a two-way switch 63.

I have described my invention in the embodiment preferred by me, but wish to claim the same broadly as well as specifically, as pointed out in the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In an apparatus of the class described, the combination of a room to be conditioned, an air conditioner, a constant speed centrifugal fan having a rotatable fan wheel, means for delivering constant proportions of conditioned and re-circulated air to said fan comprising a re-circulation duct leading from said room to said fan, a return duct leading from said room to said conditioner, an outside duct leading from a source of unconditioned air to said conditioner, inter-connected dampers in said return duct and said outside duct adapted to proportion the volume of air passing through said ducts without varying the volume of air passing to said conditioner, and a duct from said conditioner to said fan, a volume control means for said fan comprising a plurality of blades adapted to close off the air or in partially open position to impart to the air entering the fan a swirl in the direction of rotation of the fan wheel, a duct from said fan to said room, means for controlling the moisture in the air in the room comprising dew point control for the conditioner, and means for controlling the sensible heat of the air in the room comprising a thermostat in said room adapted to control said volume control means.

2. In an apparatus of the class described, the combination of a room to be conditioned, an air conditioner, a constant speed centrifugal fan having a rotatable fan wheel, means for delivering constant proportions of conditioned and re-circulated air to said fan comprising a re-circulation duct leading from said room to said fan, a return duct leading from said room to said conditioner, an outside duct leading from a source of unconditioned air to said conditioner, inter-connected dampers in said return duct and said outside duct adapted to proportion the volume of air passing through said ducts without varying the volume of air passing to said conditioner, and a duct from said conditioner to said fan, a volume control means for said fan comprising a plurality of blades adapted to close off the air or in partially open position to impart to the air entering the fan a swirl in the direction of rotation of the fan wheel, a duct from said fan to said room, means for controlling the moisture in the air in the room comprising dew point control for the conditioner, and means for controlling said volume control means under control of conditions in the room.

3. In an apparatus of the class described, the combination of a room to be conditioned, an air conditioner, a constant speed centrifugal fan having a rotatable fan wheel, means for delivering

constant proportions of conditioned and re-circulated air to said fan comprising a re-circulation duct leading from said room to said fan, a return duct leading from said room to said conditioner, an outside duct leading from a source of unconditioned air to said conditioner, and a duct from said conditioner to said fan, a volume control means for said fan comprising a plurality of blades adapted to close off the air or in partially open position to impart to the air entering the fan a swirl in the direction of rotation of the fan wheel, a duct from said fan to said room, means for controlling the moisture in the air in the room comprising dew point control for the conditioner, and means for controlling said volume control means under control of conditions in the room.

4. In an apparatus of the class described, the combination of a room to be conditioned, an air conditioner, a constant speed centrifugal fan having a rotatable fan wheel, a volume control for said fan comprising a plurality of blades adapted when in open position to impart to air entering said fan a swirl in the direction of rotation of the fan wheel, and means under control of conditions in the room for controlling said volume control means, and means to conduct air from said fan to said room.

5. In an apparatus of the class described, the combination of a room to be conditioned, an air conditioner, a constant speed centrifugal fan having a rotatable fan wheel, a volume control for said fan adapted when in open position to impart to air entering said fan a swirl in the direction of rotation of the fan wheel, means under control of conditions in the room for controlling said volume control means, and means to conduct air from said fan to said room.

6. In an apparatus of the class described the combination of a room to be conditioned, an air conditioner, a constant speed centrifugal fan having a rotatable fan wheel, means under control of conditions in the room for controlling said conditioner, a volume control for said fan comprising a plurality of blades adapted when in open position to impart to air entering said fan a swirl in the direction of rotation of the fan wheel, and means under control of conditions in the room for controlling said volume control means, and means to conduct air from said fan to said room.

7. In an apparatus of the class described, the combination of a room to be conditioned, an air conditioner, a constant speed centrifugal fan having a rotatable fan wheel, a duct leading from said room to said fan, a duct leading from said room to said conditioner, a duct from said conditioner to said fan, a volume control for said fan comprising a plurality of blades adapted when in open position to impart to air entering said fan a swirl in the direction of rotation of the fan wheel, means under control of conditions in the room for controlling said conditioner, means under control of the conditions in the room for controlling said volume control means and means to conduct air from said fan to said room.

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