

Oct. 5, 1965

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AIR CONDITIONING UNIT  
Filed July 18, 1963

3,209,668

FIG. 1

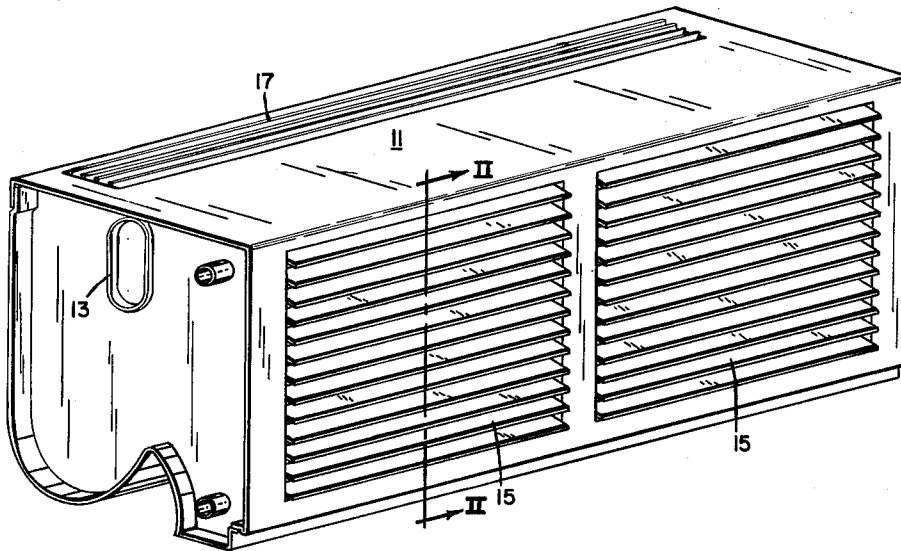
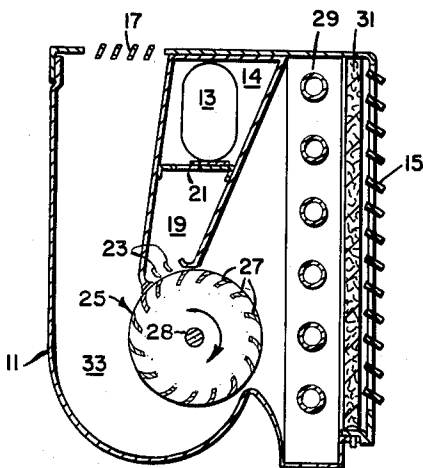


FIG. 2



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3,209,668

## AIR CONDITIONING UNIT

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Filed July 18, 1963, Ser. No. 295,934

2 Claims. (Cl. 98—38)

This invention relates generally to air conditioning units and more particularly to room units of the induction type for multi-room building structures.

Units of the type herein under consideration are employed in air conditioning systems wherein a first volume of air is conditioned to a desired degree at a central conditioning point and then distributed at relatively high static pressure and at high velocity to a plurality of units disposed in and serving a plurality of areas or enclosures to be conditioned. The first volume of air, generally known as primary air, is supplied to each unit for discharge therethrough, frequently through nozzle formations such as those disclosed in United States Patent No. 2,962,953 granted December 6, 1960 to Ashley et al., and the like; and in this manner induces a relatively great secondary circulation of air withdrawn from the area served by the unit. High pressure is employed to obtain a high induction ratio by the unit and also to overcome a fair size pressure drop due to air flow through the grill, filter, and heat exchange means within each unit. The high induction rate is obtained by the employment of a nozzle arrangement to supply the high velocity primary air for inducing sufficient amounts of recirculated air into the unit.

The primary or high pressure air is conditioned to a predetermined dew point at the central conditioning point, and tempering means, such as a heat exchange coil or the like, is disposed within the various local units to effect sensible cooling or heating of air circulated through the unit as required. The primary air preferably comprises outside air, and generally there is employed one part of primary air for each four parts of secondary or recirculated air supplied to each conditioned enclosure.

The high pressure primary air is produced by a blower in the central conditioner and supplied through small ductwork at high static pressure to a plurality of induction units. The nature of this system requires a large amount of horsepower and is, of necessity, at a high noise level. Further, because of the employment of a nozzle arrangement to eject the primary air within each unit for the purpose of inducing secondary or recirculated air, there is a further problem in that the noise level is increased due to air leaving the narrow restriction of the nozzle and a shearing action between primary and secondary air that results from the velocity difference between these two streams of air. Therefore, in the design of a nozzle arrangement, the goal is to maintain this velocity difference to an absolute minimum which is quite difficult and cannot readily be accomplished.

It is the primary object of this invention to obviate the disadvantages inherent in a high pressure system by providing an improved high capacity unit of the induction type for an air conditioning system which will have increased efficiency at a reduced horsepower requirement.

Another object of this invention is to reduce the noise level in induction type units by adapting a transverse-flow blower for use in such a unit.

A further object of this invention is to overcome the flow instability associated in transverse-flow blowers and employ the primary air as the means effecting stability while functioning as a motive force to impel the blower.

This invention relates to an air conditioning unit comprising in combination, a base unit including a plenum chamber which receives primary air from a central conditioning unit, blower means for inducing and mixing

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secondary air with primary air wherein the primary air furnishes the motive force to drive the blower, tempering means for conditioning the secondary or recirculated air, recirculated air intake, filtering means, an exhaust chamber and a discharge outlet.

The attached drawing illustrates a preferred embodiment of the invention in which:

FIGURE 1 is a perspective view of an induction unit of the present invention; and

FIGURE 2 is a sectional view of the induction unit shown in FIGURE 1, taken along the lines II—II.

The term "transverse-flow fan" as used herein means an impeller in which the air is drawn inward at a first peripheral point and is discharged outward from a different section of the fan periphery wherein the air flow entering and leaving is in a substantially radial direction having at least some tangential component under the influence of the rotative motion of the fan.

Referring to the drawings, there is shown an induction unit in a preferred form according to this invention having a casing 11 with a primary air intake connection 13 of an upper chamber 14 adapted to be connected to the conduit system leading from a central conditioning point and including a secondary or recirculated, air intake grill 15 and a discharge outlet grill 17. A plenum chamber 19 is located below the upper chamber 14 and has a primary air damper 21 disposed therebetween. Inlet guide vanes 23 are located at the terminal end of said plenum chamber adjacent to a transverse-flow fan 25 which has a plurality of elongated blades 27 parallel to the longitudinal axis thereof. The transverse-flow fan 25 is of the usual construction having a central hub, not shown, mounted on a shaft 28 which is in turn journaled within bearings, not shown, on either side of casing 11. Other constructions are also contemplated; for example, the fan may comprise a plurality of spaced disks axially aligned along the mounting shaft wherein at least the disk at the end to which the primary air would be directed, has a roughened surface by being fluted, serrated or any other means.

At the front of the casing 11 is located a tempering means, or heat exchange coil 29 adjacent to the secondary air intake grill 15 and has a filter medium 31 juxtaposed between the coil 29 and grill 15. On the opposing side of casing 11 is an exhaust chamber 33 in communication with the discharge outlet grill 17.

In operation, a central station (not shown) supplies conditioned air to the upper chamber 14 through a duct connected to the air intake connection 13 of the induction unit. Some of the primary air sufficient to meet the requirements then passes through the damper 21 into the plenum chamber 19 and leaves the plenum chamber through inlet guide vanes 23 which tangentially direct the air upon some of the blades 27 of the transverse-flow fan wheel 25. In this manner the primary air is employed as the motivating force driving the transverse-flow fan 25 in a clockwise direction.

According to the preferred embodiment of this invention, primary air enters the transverse-flow fan 25 through the spaces between the blades 27 that are juxtaposed the inlet guide vanes 23, and this air passes across the interior of the wheel and moves out through spaces between the blades 27 that are then located within the exhaust chamber 33 area. In addition to the primary air, secondary or recirculated air is induced through the tempering means 29 and passes through the spaces between the blades 27 that are within the area adjacent to the tempering means 29. This secondary air mixes with the primary air and emerges with it passing through the spaces between the blades 27 that are within the exhaust chamber 33 area, into the chamber 33 and discharged to the room through the outlet 17.

It will be noted that the transverse-flow fan of this invention may be of any desired length, since the length of the wheel in no way influences the operation of the fan of this invention. In order to vary the output of the fan of the invention, it is only necessary to change the speed of rotation of the fan accordingly by properly adjusting the damper 21. Furthermore, with the fan of the invention, there are no operating characteristics which change suddenly at two speeds of operation that are close to each other. In other words, when increasing or decreasing the speed of rotation of the fan of the invention, there is no danger of passing through certain regions of aerodynamic instability as in the case with other known fans.

This invention provides a novel employment of a transverse-flow fan in an induction unit which not only improves the efficiency of the unit over those in the prior art, but does so at a considerable reduction in the noise level as compared to those units employing a nozzle arrangement for induction of recirculated air. In addition, there is obtained a very good mixing of the primary and recirculated air within the unit of this invention which is then discharged therefrom into the area to be conditioned. Also, the transverse-flow fan efficiency is increased due to the overcoming of the inherent instability by the manner of employment in which primary air is utilized to motivate its rotation.

While I have described a preferred embodiment of the invention, various other advantages and applications will occur to those skilled in the art and it will be understood that the invention is not limited thereto since it may be embodied within the scope of the following appended claims.

I claim:

1. In an air conditioning unit, the combination of a casing having an air intake and an air outlet, a plenum chamber in said casing adapted to receive primary air supplied through a conduit system from a central conditioning point, said plenum chamber having an outlet therein, a transverse flow fan having a plurality of elongated blades adjacent the periphery of the fan, said fan serving to draw air inward at a first peripheral point and to discharge air outwardly from a different section of the fan periphery; said fan being placed within the casing adjacent the outlet of said plenum chamber, means within said plenum chamber adjacent the chamber outlet adapted to direct primary air tangentially to the blades of the fan, primary air discharged through the

chamber outlet against the fan blades serving to rotate the fan, a coil in said casing for tempering secondary air, rotation of the fan by the discharge of primary air inducing secondary air through said intake and through the coil into the fan through its periphery to mix with the primary air, the mixture of primary and secondary air being discharged through a different section of the fan periphery, an exhaust chamber adjacent the fan receiving the mixture of primary and secondary air from the fan, said exhaust chamber being in communication with the casing outlet to discharge the mixture into the area being conditioned.

2. In an air conditioning unit, the combination of a casing having an air intake and an air outlet, a plenum chamber in said casing adapted to receive primary air supplied through a conduit system from a central conditioning point, said plenum chamber having an outlet therein, a transverse flow fan having a plurality of elongated blades adjacent the periphery of the fan, said fan serving to draw air inward at a first peripheral point and to discharge air outwardly from a different section of the fan periphery; said fan being placed within the casing adjacent the outlet of said plenum chamber, inlet guide vanes within said plenum chamber adjacent the chamber outlet adapted to direct primary air tangentially to the blades of the fan, primary air discharged through the chamber outlet against the fan blades serving to rotate the fan, a coil in said casing for tempering secondary air, rotation of the fan by the discharge of primary air inducing secondary air through said intake and through the coil into the fan through its periphery to mix with the primary air, the mixture of primary and secondary air being discharged through a different section of the fan periphery, an exhaust chamber adjacent the fan receiving the mixture of primary and secondary air from the fan, said exhaust chamber being in communication with the casing outlet to discharge the mixture into the area being conditioned.

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