US 20050087614A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2005/0087614 A1**

Ruise (43) **Pub. Date: Apr. 28, 2005**

(54) **METHOD AND APPARATUS FOR DELIVERING HEATED OR CONDITIONED AIR TO A REMOTE ROOM IN A STRUCTURE**

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(21) Appl. No.: **10/972,631**

(22) Filed: **Oct. 25, 2004**

Related U.S. Application Data

(60) Provisional application No. 60/513,905, filed on Oct. 23, 2003.

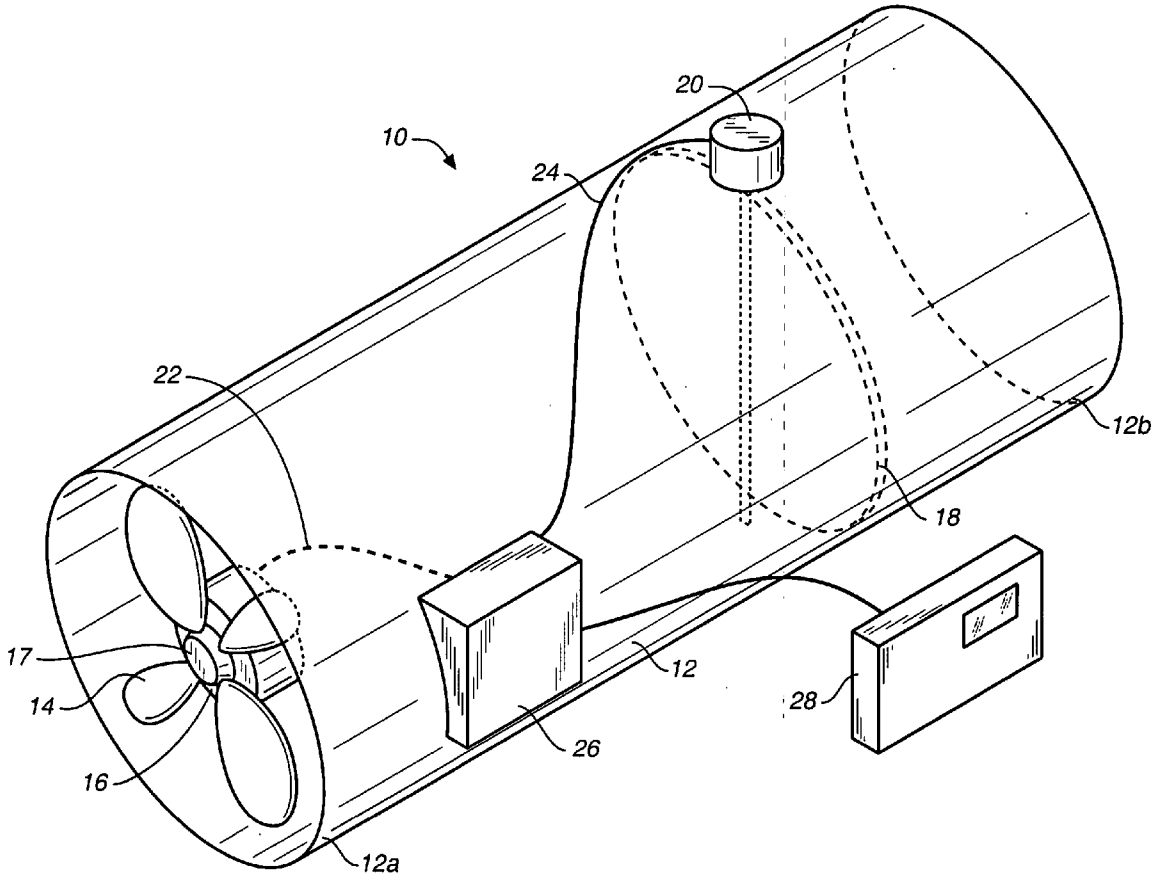
Publication Classification

(51) **Int. Cl.**[7] **F24F 7/00**; F25D 17/04

(52) **U.S. Cl.** **236/49.3**; 62/186

(57) **ABSTRACT**

The invention provides an integrated blower, motorized damper, and thermostat apparatus comprising an area-specific booster unit incorporated into selected locations of the ventilation ductwork of a building, which facilitates rapid delivery of heated or conditioned air to remote rooms in structures having a central source of forced air.



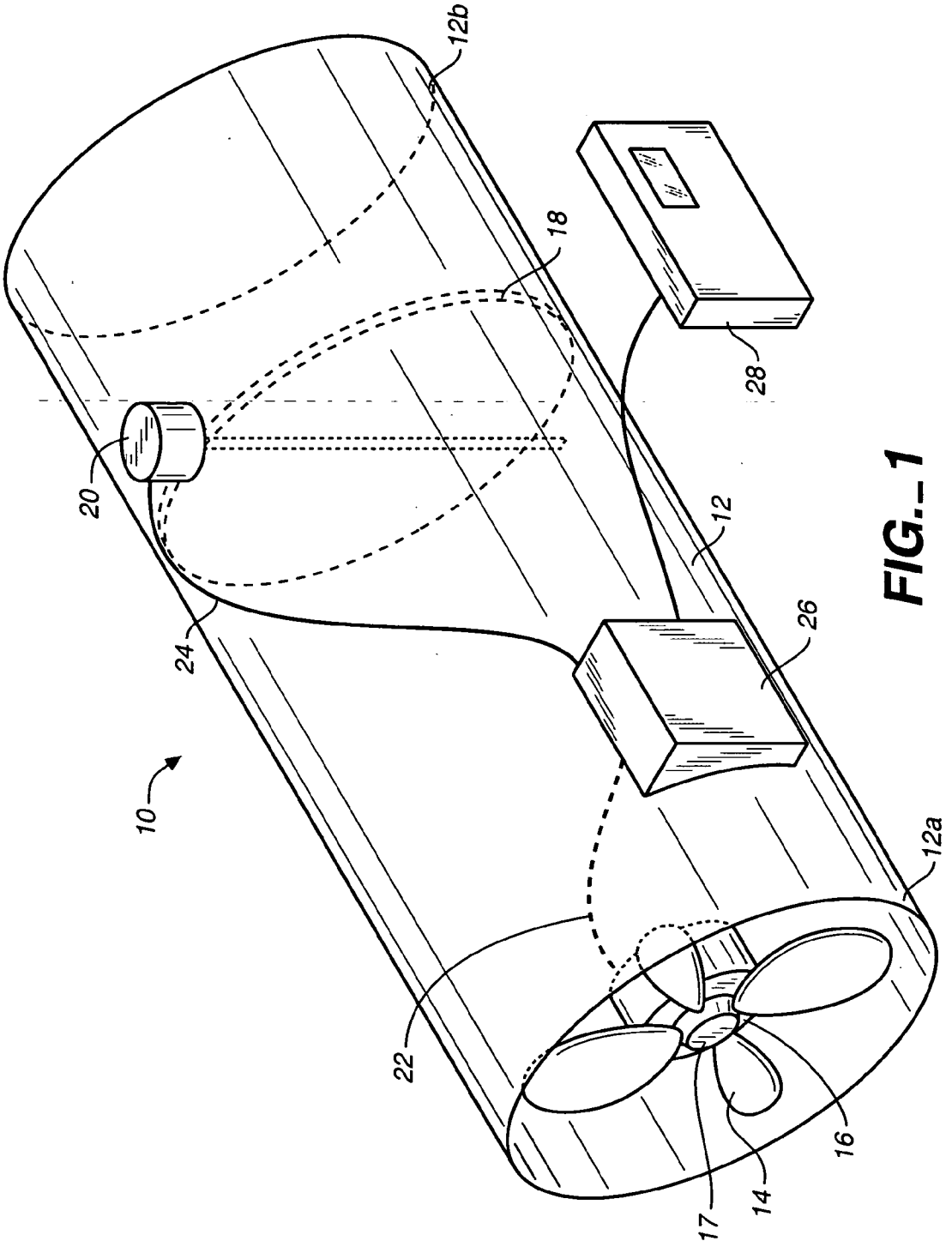


FIG._1

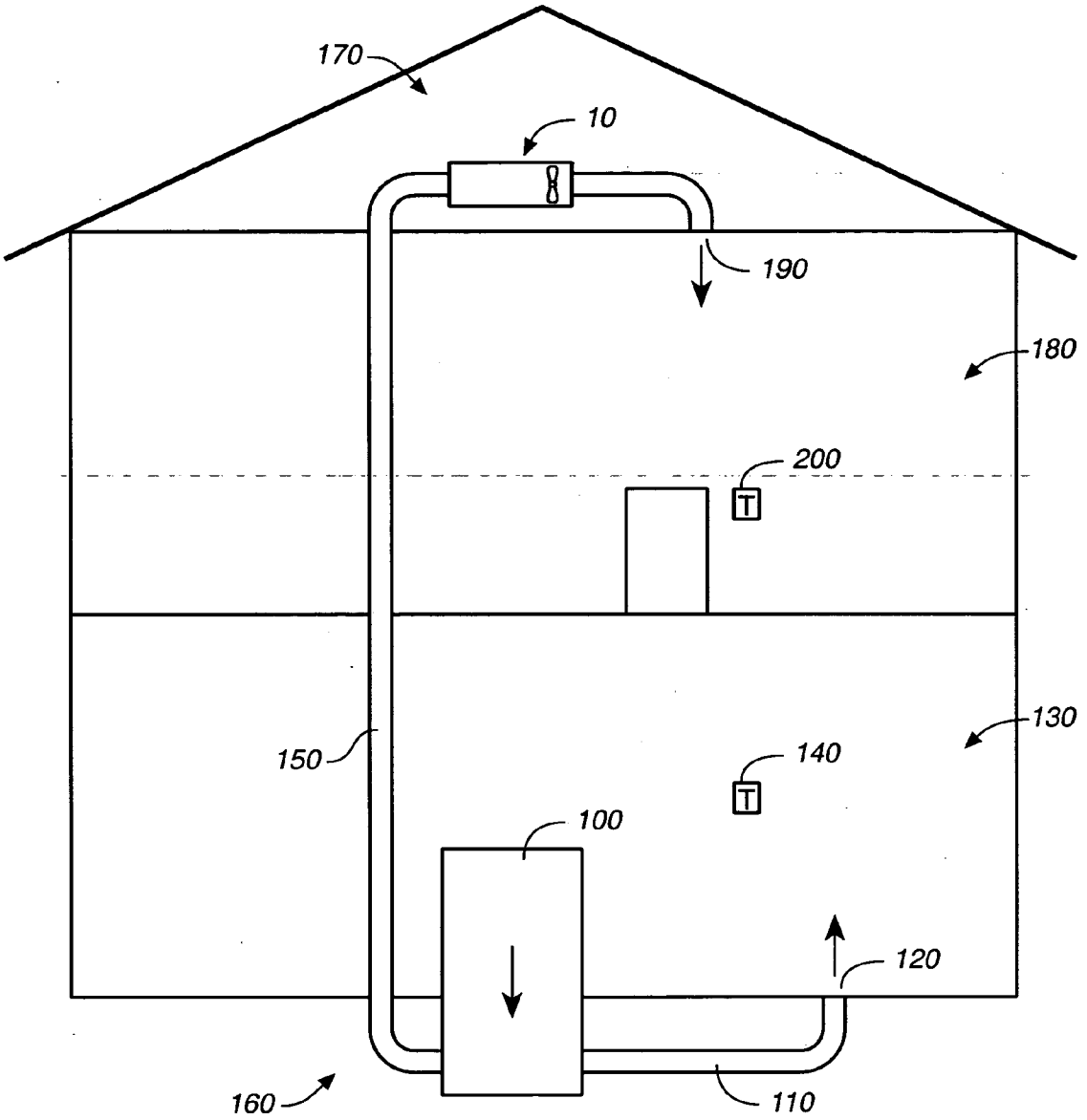


FIG._2

METHOD AND APPARATUS FOR DELIVERING HEATED OR CONDITIONED AIR TO A REMOTE ROOM IN A STRUCTURE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the benefit of the filing date of U.S. Provisional Patent Application Ser. No. 60/513,905, filed 23 Oct. 2003.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not applicable.

REFERENCE TO A MICROFICHE APPENDIX

[0003] Not applicable.

TECHNICAL FIELD

[0004] The present invention relates generally to residential and commercial heating, ventilation, and air conditioning (HVAC) systems, and more particularly to an improved method and apparatus for delivering heated and/or conditioned air to a remote room in a building structure.

BACKGROUND INFORMATION AND DISCUSSION OF RELATED ART

[0005] Residents of multi-story dwellings routinely have a problem with the proper distribution of heated and cooled air, especially to rooms on upper stories. Generally, forced air systems move heated or cooled air from a furnace or air conditioning unit through a system of ductwork to rooms in various parts of the structure. As the ducts rise or move significant distances laterally, pressure differentials develop in the duct system causing the air to flow at different rates into different rooms. Air will flow most easily in ducts with little back pressure or resistance; conversely, air will move with difficulty in risers and other ducts with higher pressure and high resistance. As a result, spaces are heated and cooled at different rates.

[0006] A well known solution to this problem is to tailor the size of the ductwork to offset pressure differentials caused by ductwork geometry and gravity. Small air supply ducts are provided for rooms proximate the furnace or air conditioning unit, and larger ducts are provided for more remote rooms. Dampers may be combined with the ductwork to provide a measure of mechanical control over air flow through the ducts.

[0007] Typically, residential heating and air conditioning systems are controlled by a single thermostat, generally located on the ground or main floor of the house. Paradoxically, the thermostat is usually located in a room having few of the problems of the rooms in the upper story or stories of the house. In the wintertime, heated air moves easily and quickly to the are surrounding the thermostat, and in the summertime, cool air moves easily and relatively quickly to the thermostat. In consequence, the rooms in the upper floors often fail to get heated or cooled air as needed. Furthermore, sun location and other ambient differences in the several rooms served by the system can give rise to temperature variations that cannot be appropriately addressed through the use of a single thermostat. For example, a cold room upstairs might necessitate running the furnace long beyond the time it is comfortable in a room on the main floor of the house.

[0008] Several solutions have been proposed to resolve the foregoing problems, among which are those disclosed in the following patents.

[0009] U.S. Pat. No. 4,394,958, to Whitney, discloses an apparatus for controlling the air flow from a register of a forced air heating system. The apparatus includes walls forming a housing or cover adapted to be fastened to and enclose an air outlet register. The walls also form an outlet opening, and a pivotable flapper valve or wall is provided that is movable to close the opening. The valve is pivotable between an open position where the opening is not closed, and a closed position where the opening is obstructed, the valve being biased to the open position. The valve is located to be subjected to the force of air moving out of the register and through the housing, this force being such as to urge the valve to the closed position. The apparatus further includes a latch for holding the valve in the open position against the force of the moving air, and an electric control for disabling the latch in the presence of the flow of air. The electric control may be manually operated or it may be responsive to the ambient temperature conditions.

[0010] U.S. Pat. No. 4,557,418, to Leemhuis, teaches a ductstat in the bonnet of the source of heated or cooled air which controls the source according to an ideal narrow desired temperature range in the bonnet. Ductwork radiates from the bonnet to various rooms in the building. A blower at the central source forces the air in the bonnet through the ducts and out into the various rooms. A dual mode constant volume fluid flow controller in each duct regulates the flow of fluid through the duct according to the temperature in the room to be conditioned and to air flow changes in the duct as measured by a vane in the duct. A baffle rotated by an electric motor opens or closes as determined by the controller.

[0011] U.S. Pat. No. 5,980,381, to McCormick, shows a vent assembly for controlling flow of air into a room. The assembly comprises a housing and a damper mounted within the housing. The housing is mounted to a surface of the room such that air passing through an air duct pass through a passageway defined by the housing. Air flowing through the passageway causes the damper to rotate into an open position; when no air is flowing through the passageway, gravity or another force (such as a return spring) causes the damper to remain in a closed position. A controller may be provided to allow the damper member to placed into a locked closed configuration, a locked open configuration, or an open configuration.

[0012] The foregoing patents reflect the current state of the art of which the present inventor is aware. Reference to, and discussion of, these patents is intended to aid in discharging Applicant's acknowledged duty of candor in disclosing information that may be relevant to the examination of claims to the present invention. However, it is respectfully submitted that none of the above-indicated patents disclose, teach, suggest, show, or otherwise render obvious, either singly or when considered in combination, the invention described and claimed herein.

BRIEF SUMMARY OF THE INVENTION

[0013] The present invention provides a method and apparatus for delivering heated or conditioned air to a remote room in a building structure. The inventive apparatus includes an integrated blower, motorized damper, and thermostat apparatus comprising an area-specific booster unit incorporated into selected locations of the ventilation ductwork of the building, which facilitates rapid delivery of heated or conditioned air to remote rooms in structures having a central source of forced air.

[0014] It is therefore an object of the present invention to provide a new and improved heating and air conditioning apparatus.

[0015] It is another object of the present invention to provide a new and improved method for delivering conditioned air throughout a building structure.

[0016] A further object or feature of the present invention is a new and improved blower, motorized damper, and thermostat for HVAC systems.

[0017] An even further object of the present invention is to provide a novel booster unit for delivering ventilation air to a remote room.

[0018] Other novel features which are characteristic of the invention, as to organization and method of operation, together with further objects and advantages thereof will be better understood from the following description considered in connection with the accompanying drawing, in which preferred embodiments of the invention are illustrated by way of example. It is to be expressly understood, however, that the drawing is for illustration and description only and is not intended as a definition of the limits of the invention. The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming part of this disclosure. The invention resides not in any one of these features taken alone, but rather in the particular combination of all of its structures for the functions specified.

[0019] There has thus been broadly outlined the more important features of the invention in order that the detailed description thereof that follows may be better understood, and in order that the present contribution to the art may be better appreciated. There are, of course, additional features of the invention that will be described hereinafter and which will form additional subject matter of the claims appended hereto. Those skilled in the art will appreciate that the conception upon which this disclosure is based readily may be utilized as a basis for the designing of other structures, methods and systems for carrying out the several purposes of the present invention. It is important, therefore, that the claims be regarded as including such equivalent constructions insofar as they do not depart from the spirit and scope of the present invention.

[0020] Further, the purpose of the Abstract is to enable the U.S. Patent and Trademark Office and the public generally, and especially the scientists, engineers and practitioners in the art who are not familiar with patent or legal terms or phraseology, to determine quickly from a cursory inspection the nature and essence of the technical disclosure of the application. The Abstract is neither intended to define the invention of this application, which is measured by the claims, nor is it intended to be limiting as to the scope of the invention in any way.

[0021] Certain terminology and derivations thereof may be used in the following description for convenience in reference only, and will not be limiting. For example, words such as "upward,""downward,""left," and "right" would refer to directions in the drawings to which reference is made unless otherwise stated. Similarly, words such as "inward" and "outward" would refer to directions toward and away from, respectively, the geometric center of a device or area and designated parts thereof. References in the singular tense include the plural, and vice versa, unless otherwise noted.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0022] The invention will be better understood and objects other than those set forth above will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

[0023] **FIG. 1** is perspective view of an integrated assembly of an apparatus of the present invention, showing interior elements in phantom; and

[0024] **FIG. 2** is a schematic side view of a typical installation of the inventive apparatus.

DETAILED DESCRIPTION OF THE INVENTION

[0025] Referring to **FIGS. 1 and 2**, wherein like reference numerals refer to like components in the various views, there is illustrated therein a new and improved apparatus for delivering heated or conditioned air to a remote room. The inventive apparatus, generally denominated **10** herein, comprises a section of ductwork **12**, typically ten or twelve inches in diameter, having a blower impeller **14** and blower motor **16** (collectively a booster fan **17**, preferably 120V) disposed at one end **12***a* thereof, and a damper **18** driven by a damper motor **20** (preferably 24V) disposed at the other end **12***b*. Collectively, the apparatus comprises an area-specific air booster unit. The actual physical configuration and proximity to the duct section ends is not critical to system functioning. In fact, although it is preferable that the booster fan be more proximate the central air supply (with respect to air flow) than the damper, even that positioning is not imperative.

[0026] Both the damper motor and the blower motor are electrically wired via wires **22**, **24**, to a housing **26** which contains a double-pole, double throw relay and a 24/120V transformer (not shown) electrically coupled to a residential electrical circuit, and operated by thermostat **28**, which is located in a room to register ambient air temperature.

[0027] In this configuration, the inventive apparatus is adapted for installation in the upper story or remote room ductwork of residential HVAC systems. The heated or cooled air reaching the upper floors or remote rooms from most such systems is generally driven by blowers in the lower floors and possibly by booster fans in risers. However, there is no known integrated combination of blower, damper, and thermostat that allows for room-specific control

of increased or decreased air flow. For a particular room, the occupant may set the thermostat to a desired level, and the blower will turn on and the damper open to boost the flow of direct heated or cooled air into the room—and to reverse the process to turn the blower off and close the damper when the desired temperature is reached. In this manner, as air movement becomes impeded by increasing resistance and/or pressure, the booster fan and damper provide means to overcome the resistance and/or pressure and rapidly move air in limited regions of the ductwork.

[0028] **FIG. 2** shows a possible installation of the present invention. In this view the central source of forced air **100** is either a furnace or an air conditioning unit (or both). A first floor supply air duct **110** terminates in a register or a vent **120** located in the first floor **130**. The main thermostat **140** has complete control of the central source **100**. As is customary in many, if not most, residential installations, the second floor supply air duct **150** rises from a basement or crawl space **160** to the attic **170** and then delivers conditioned or heated air to second floor **180** through a ceiling or wall vent or register **190**. Air traveling and rising this substantial distance is impeded in its movement by gravity, friction, and by bends in the ductwork. Thus, to facilitate movement of sluggish air, an area-specific booster unit **10** of this invention is placed in the attic space proximate the vent or register **190**. The damper motor and booster fan are under the control of a secondary thermostat **200**, which allows an occupant in the upper floor area **180** to bring greater air flow into the space without having to adjust the thermostat **140** on the first floor.

[0029] The advantages of the inventive system are manifold: it provides local temperature sensing; local air flow boosting; and local air flow control. In conventional forced air systems, it can increase air flow to a room by at least 600 cfm or more, depending upon the specifics of the system and ductwork.

[0030] Accordingly, the invention may be characterized as an apparatus for delivering heated or conditioned air to a remote room in a building structure, the building structure having ventilation ductwork and a central source of forced air, the apparatus including a section of ductwork having a first end and a second end; a booster fan portion disposed at the ductwork first end; a motorized damper portion disposed at the ductwork second end; and a thermostat portion positioned in the remote room and electrically connected to the booster fan portion and the motorized damper portion, wherein the thermostat operates to selectively activate the booster fan portion and open the motorized damper portion to boost the flow of direct heated or cooled air into the remote room, and to deactivate the booster fan portion and close the motorized damper portion when the desired temperature in the remote room is reached.

[0031] Alternatively, the invention may be characterized as a method for delivering heated or conditioned air to a remote room in a building structure, the building structure having ventilation ductwork and a central source of forced air, the method comprising the steps of providing a section of ductwork having a first end and a second end; providing a booster fan at the ductwork first end; providing a motorized damper at the ductwork second end; providing a thermostat in the remote room and electrically connected to the booster fan and the motorized damper; and operating the thermostat to selectively activate the booster fan and open the motorized damper to boost the flow of direct heated or cooled air into the remote room, and to deactivate the booster fan and close the motorized damper when the desired temperature in the remote room is reached.

[0032] The above disclosure is sufficient to enable one of ordinary skill in the art to practice the invention, and provides the best mode of practicing the invention presently contemplated by the inventor. While there is provided herein a full and complete disclosure of the preferred embodiments of this invention, it is not desired to limit the invention to the exact construction, dimensional relationships, and operation shown and described. Various modifications, alternative constructions, changes and equivalents will readily occur to those skilled in the art and may be employed, as suitable, without departing from the true spirit and scope of the invention. Such changes might involve alternative materials, components, structural arrangements, sizes, shapes, forms, functions, operational features or the like.

[0033] Therefore, the above description and illustrations should not be construed as limiting the scope of the invention, which is defined by the appended claims.

What is claimed as invention is:

1. An apparatus for delivering heated or conditioned air to a remote room in a building structure, the building structure having ventilation ductwork and a central source of forced air, the apparatus comprising:

a section of ductwork having a first end and a second end;

a booster fan portion disposed at said ductwork first end;

a motorized damper portion disposed at said ductwork second end; and

a thermostat portion positioned in the remote room and electrically connected to said booster fan portion and said motorized damper portion, wherein said thermostat operates to selectively activate said booster fan portion and open said motorized damper portion to boost the flow of direct heated or cooled air into the remote room, and to deactivate said booster fan portion and close said motorized damper portion when the desired temperature in the remote room is reached.

2. The apparatus for delivering heated or conditioned air to a remote room in a building structure of claim 1 further including a housing for circuitry to drive said booster fan portion and said motorized damper portion.

3. The apparatus for delivering heated or conditioned air to a remote room in a building structure of claim 2 wherein said housing is electrically coupled to a residential electrical circuit.

4. The apparatus for delivering heated or conditioned air to a remote room in a building structure of claim 1 wherein said ductwork is connected to a room register.

5. The apparatus for delivering heated or conditioned air to a remote room in a building structure of claim 1 wherein said booster fan portion comprises a blower impeller and a blower motor.

6. A method for delivering heated or conditioned air to a remote room in a building structure, the building structure having ventilation ductwork and a central source of forced air, said method comprising the steps of:

providing a section of ductwork having a first end and a second end;

providing a booster fan at the ductwork first end;

providing a motorized damper at the ductwork second end;

providing a thermostat in the remote room and electrically connected to the booster fan and the motorized damper;

operating the thermostat to selectively activate the booster fan and open the motorized damper to boost the flow of direct heated or cooled air into the remote room, and to deactivate the booster fan and close the motorized damper when the desired temperature in the remote room is reached.

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