US 20130068846A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2013/0068846 A1

(43) Pub. Date: Mar. 21, 2013

Bluestone

(54) WIRELESS CONTROLLED DAMPER

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(21) Appl. No.: **13/624,210**

(22) Filed: **Sep. 21, 2012**

Related U.S. Application Data

(60) Provisional application No. 61/626,122, filed on Sep. 21, 2011.

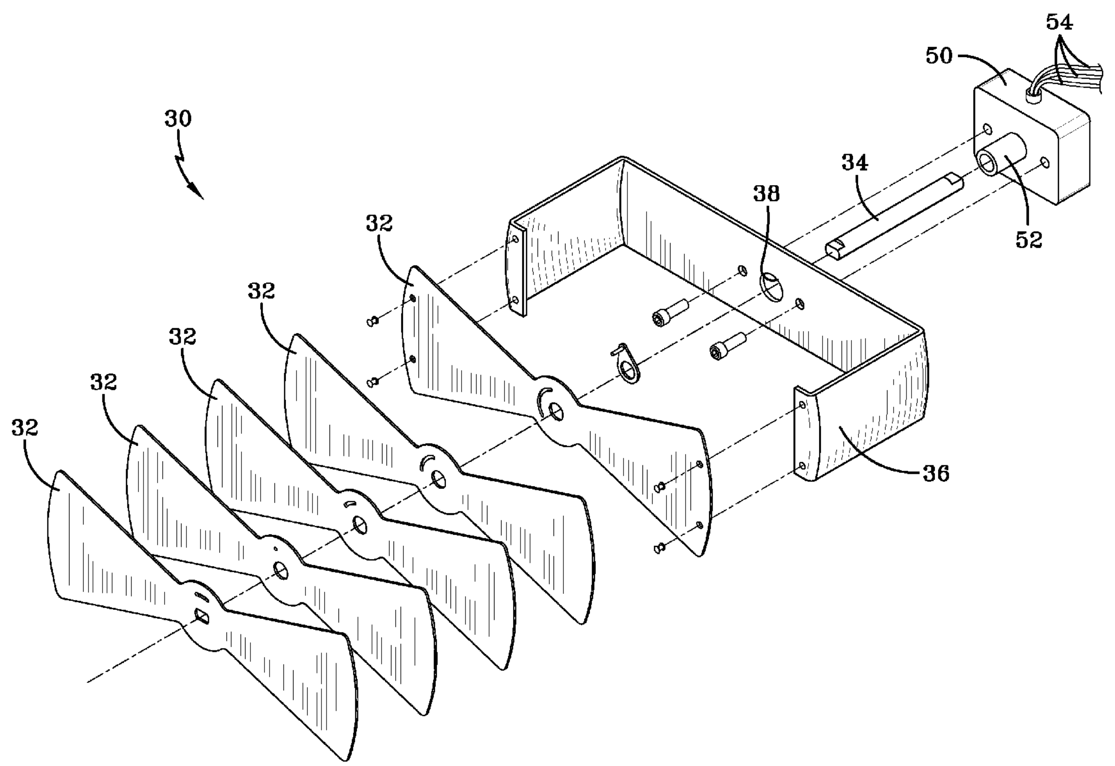
Publication Classification

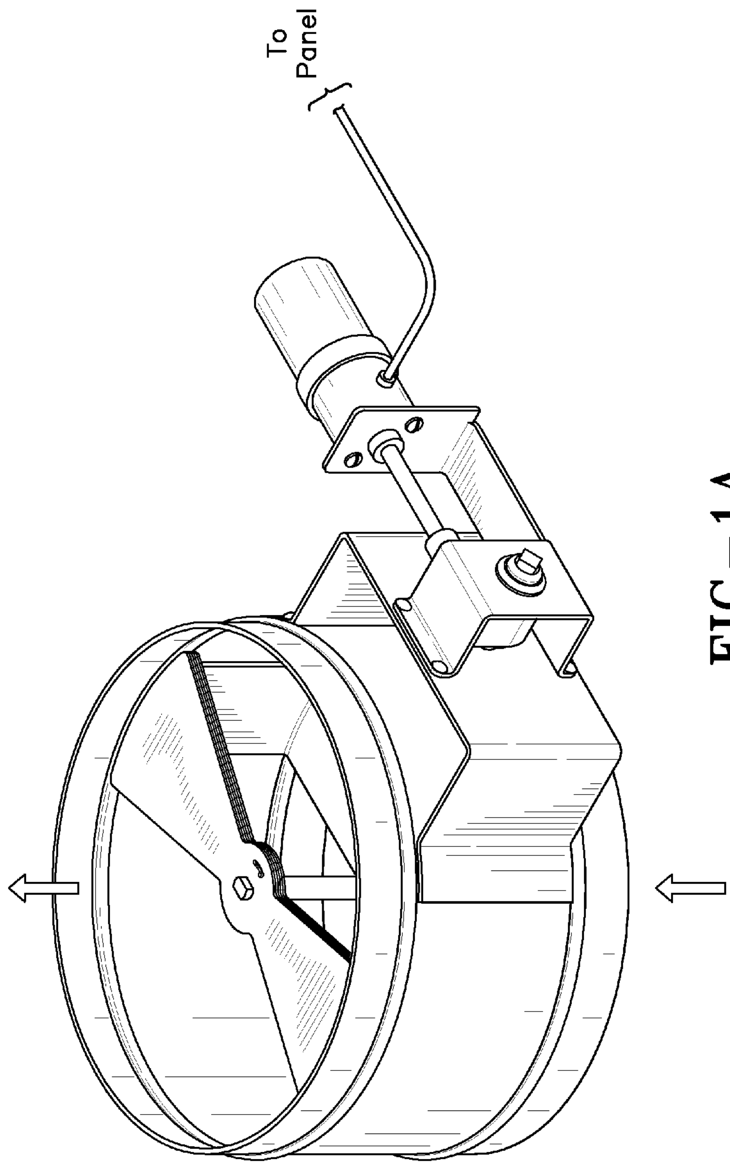
(51) **Int. Cl.**
F24F 11/053 (2006.01)
F24F 13/08 (2006.01)

(52) **U.S. Cl.**
USPC **236/49.3**; 236/51

(57) **ABSTRACT**

A wireless radial damper system includes at least one radial damper having a motor connected thereto to rotate the radial damper between an open position and a closed position inside a duct. A receiver is connected to the motor for communicating with the motor via a wireless signal. A wireless thermostat remote from the receiver sends the wireless signal to the receiver which in turn operates the motor to control the radial damper. The wireless thermostat allows for the radial damper to be temperature controlled rather than user controlled. A wireless remote controller, a wireless wand or some other type of wireless device may be used in place of a wireless thermostat.





FIG—1A
PRIOR ART

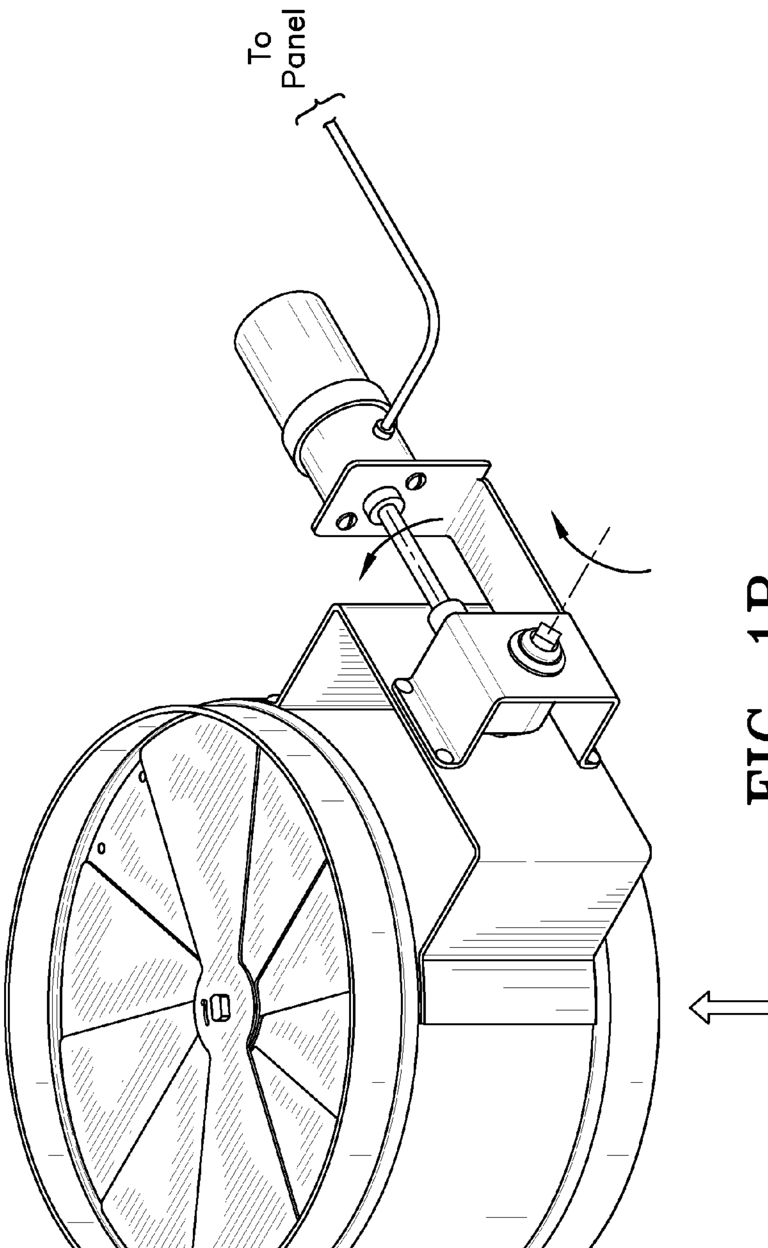
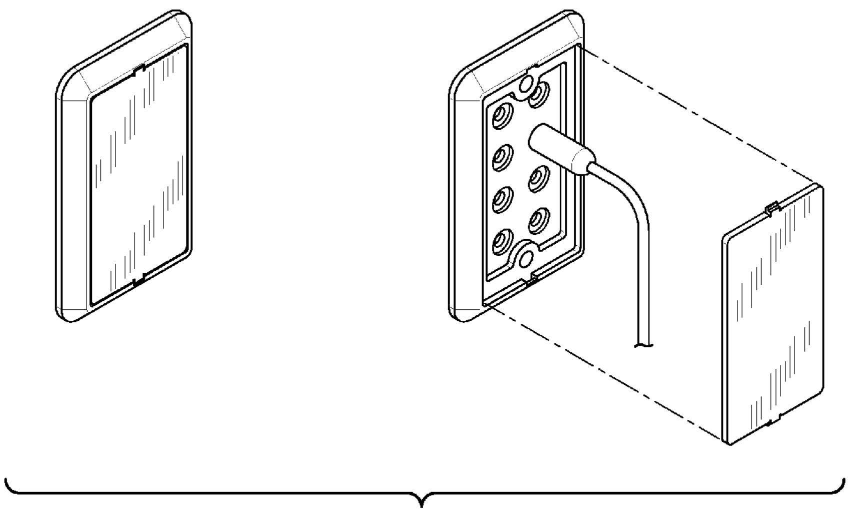
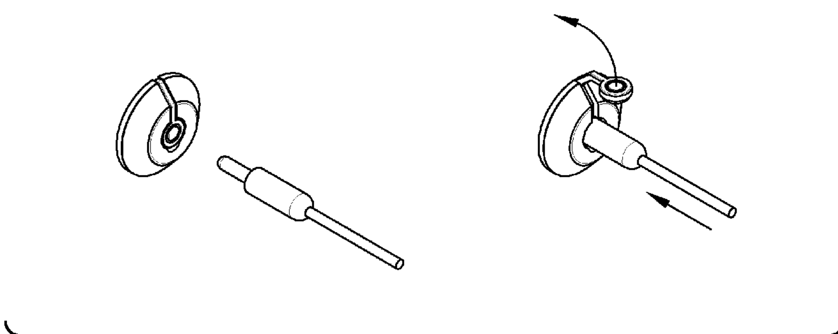


FIG-1B
PRIOR ART



FIG–2
PRIOR ART



FIG–3
PRIOR ART

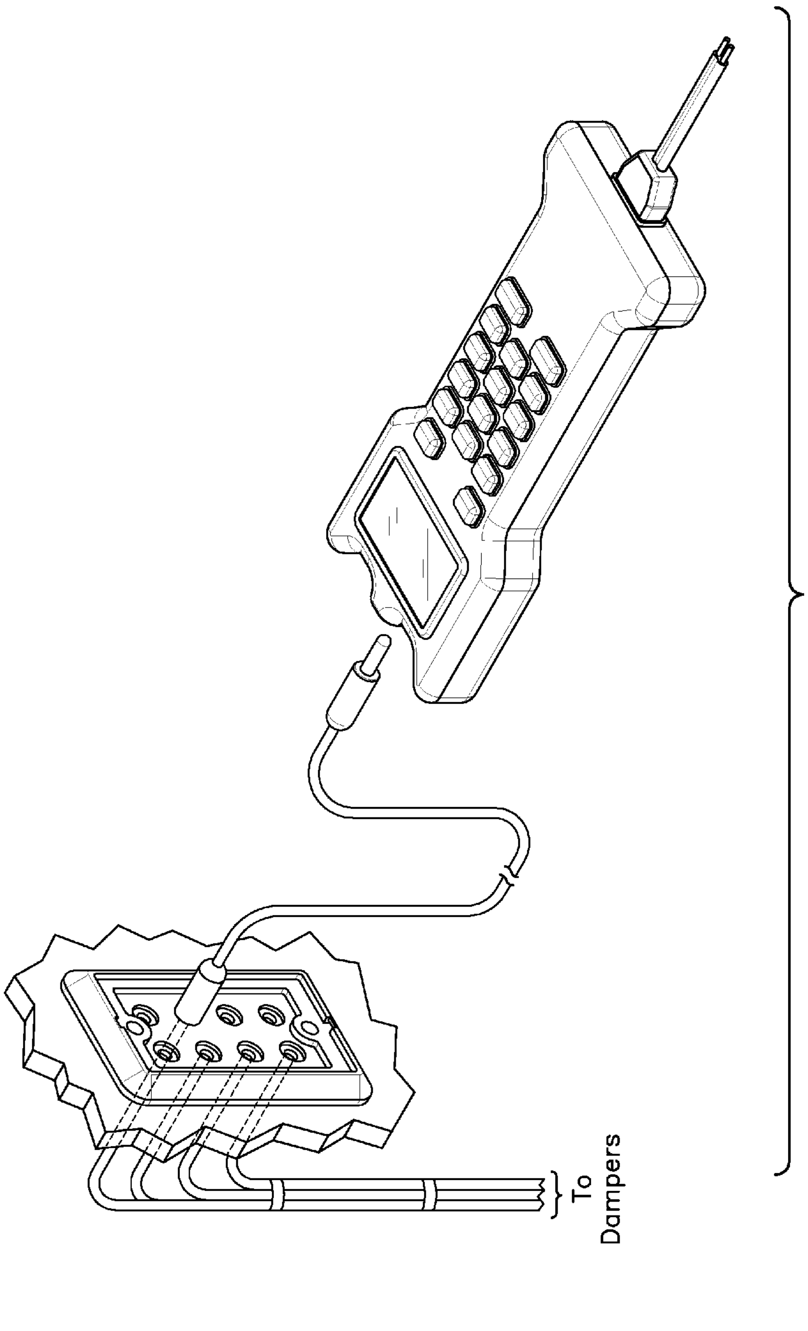


FIG-4
PRIOR ART

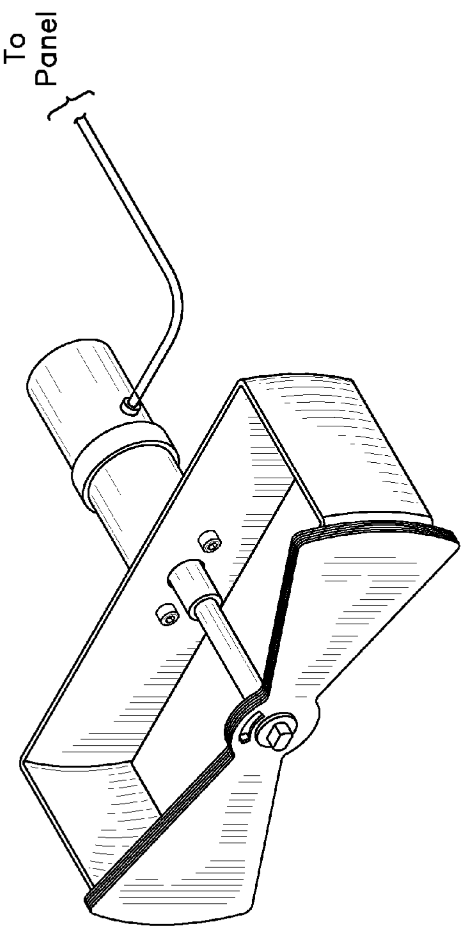
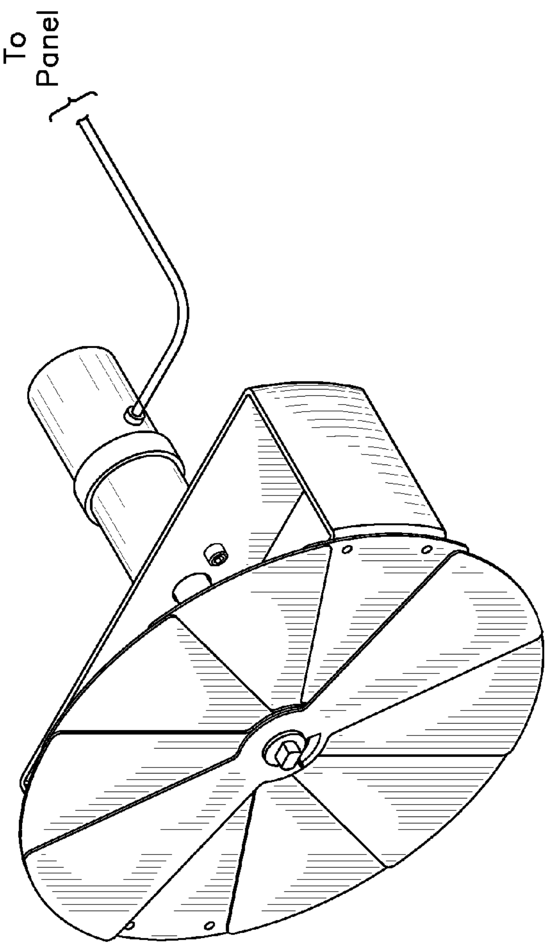
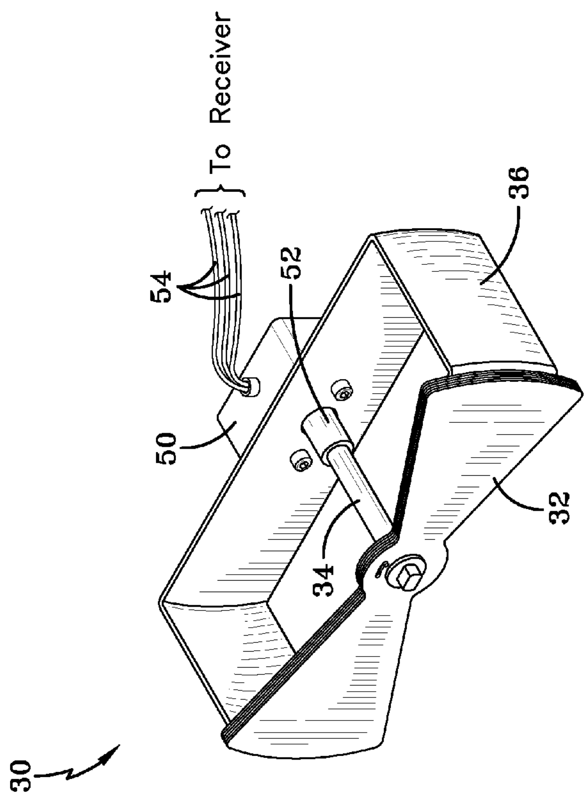


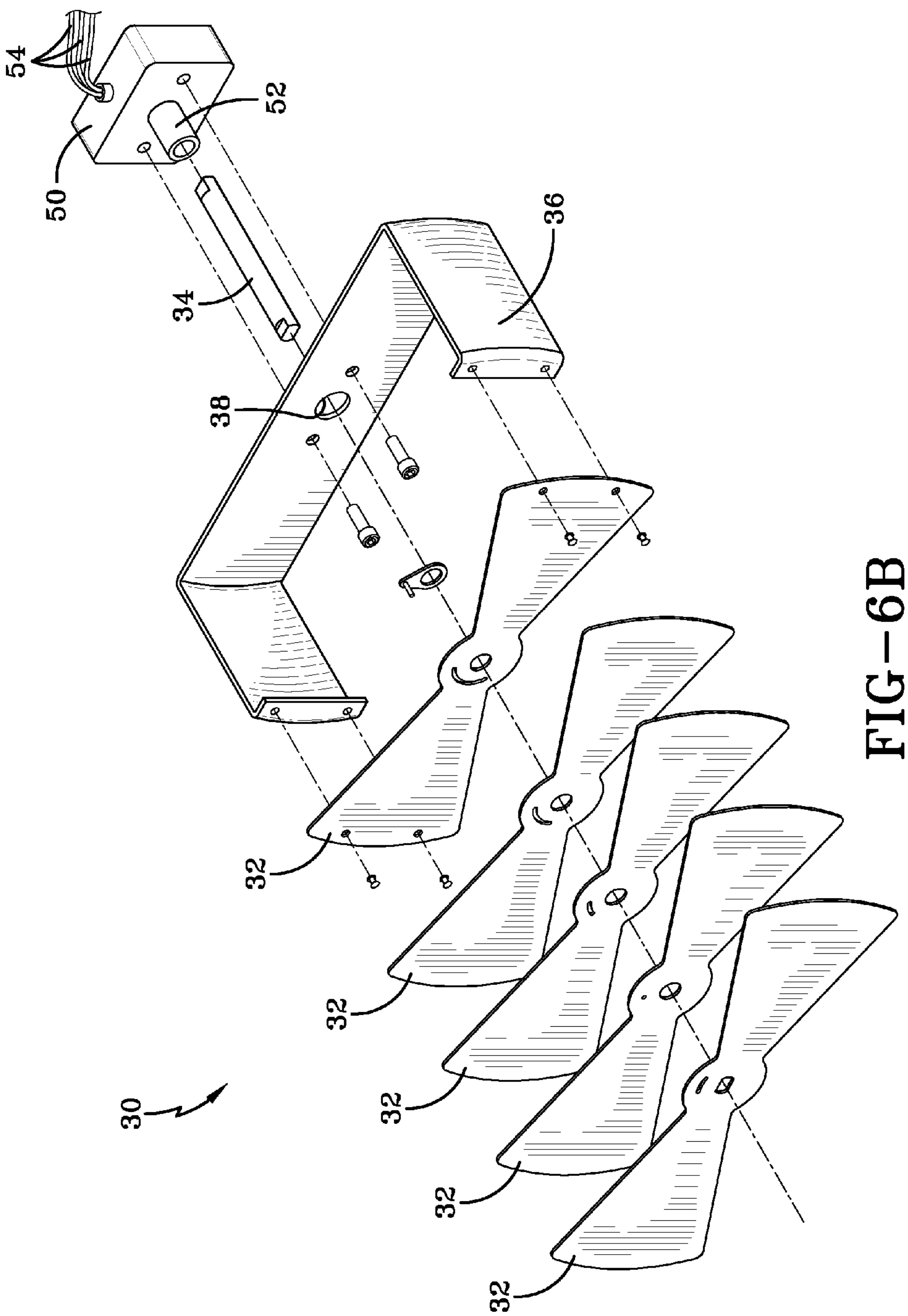
FIG-5A
PRIOR ART



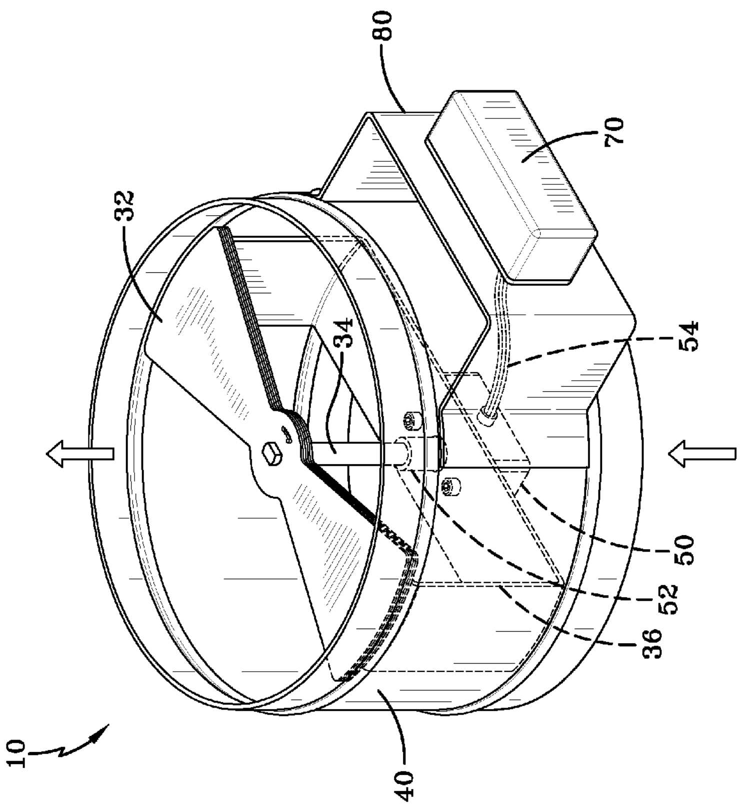
FIG—5B
PRIOR ART



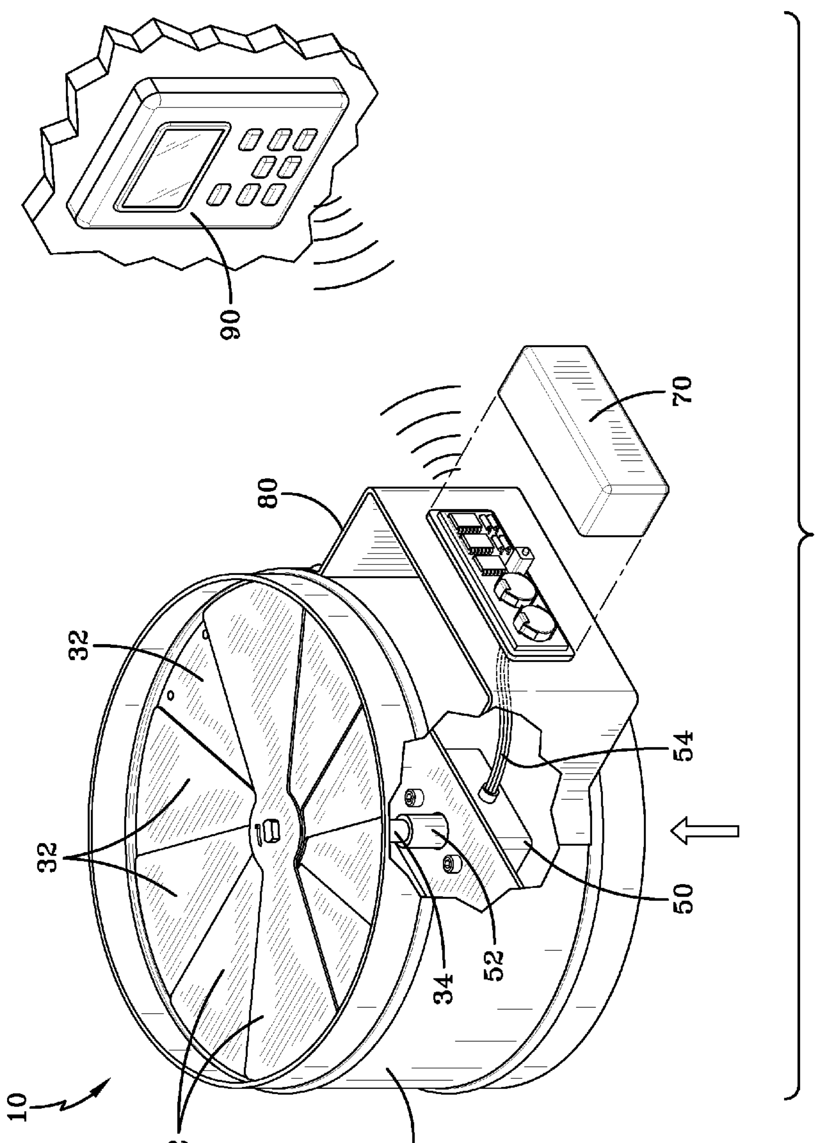
FIG—6A



FIG—6B



FIG–7A



FIG–7B

WIRELESS CONTROLLED DAMPER

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority of U.S. Provisional Application Ser. No. 61/626,122 filed on Sep. 21, 2011.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to radial damper systems, and more particularly to a wireless radial damper system utilizing various types of motors operatively connected to a wireless thermostat or wireless remote control.

[0004] 2. Description of the Prior Art

[0005] Various types of damper systems are known in the art and are used to control air flow in ventilation systems of homes, apartments, warehouses, buildings, etc.

[0006] Dampers vary the volume of air passing through an air outlet, inlet, or duct but do not significantly affect the shape of the delivery pattern. Specifically, a radial damper may be used to cut off central air conditioning (heating or cooling) to an unused room, or to regulate it for room-by-room temperature and climate control. Its operation can be manual, mechanical or can include a motorized gear and coupling system. Radial dampers are advantageous when there is limited space for installation in and around the air duct. This is because the radial damper blades rotate clockwise or counterclockwise within a single plane of the duct. On the other hand, for example, a single round damper blade must have enough space to rotate 90 degrees in order to fully open and fully close the damper, and therefore this rotational movement is not limited to a single plane inside the duct.

[0007] Manual radial dampers are turned by a handle on the outside of a duct and thus one must have access to the outside of the duct in order to adjust the damper. Since most ductwork and ventilation systems are hidden above finished ceilings or behind walls, manual dampers are not easily accessible.

[0008] Mechanically activated radial dampers are activated in a number of ways. One such way is through the use of a cable and is known as a cable operated damper system, such as those shown in U.S. Pat. Nos. 5,702,298 and 7,793,917. A rotary actuation cable is used to mechanically rotate the damper. In this system, the rotary actuation cable transmits torque from a remote torque inducing tool (i.e. a nut driver, a screwdriver, or a knob) to a damper regulator for regulating the damper. The rotary actuation cable is attached to the damper using a cable bracket. Another cable bracket may be used to secure the other end of the rotary actuation cable where the torque inducing tool is used to operate the damper, which is remote from the damper. This latter end of the rotary actuation cable is typically accessible through a ceiling in order to use the torque inducing tool to control the damper. The actuation cable may also be accessible through a wall, vent cover, etc., although such areas are usually close to the ceiling since the rotary actuation cable cannot be located very far from the damper in order for rotary actuation cable to function. A cable termination fixture can be used to cover up this end of the rotary actuation cable at the ceiling, wall, vent cover, etc.

[0009] In order to adjust the mechanically activated damper described above, a person must be able to reach the termination fixture at the ceiling, wall, vent cover, etc. Since most ceilings are at least eight feet high (and sometimes considerably higher such as vaulted ceilings), a person must use a step ladder or some other device to be able to reach the termination fixture. Once within reach, a cover of the termination fixture must be removed in order to grant access to the end of the rotary actuation cable. After the cover of termination fixture is removed, the person must use the torque inducing tool while standing on the step ladder (or other similar device) to physically turn the rotary actuation cable in order to adjust the damper. This position can put strain on the person's back due to excessive reaching. Additionally, the person is susceptible to falling off the step ladder since one or both hands are used to turn the torque inducing tool which may result in serious injury to the person. Thus, this type of mechanically activated damper includes a number of safety hazards for a person when adjusting the damper.

[0010] Another type of damper is a motorized gear and coupling system, such as those disclosed in U.S. Publication Nos. 2009011373 and 20090181611. These patent publications disclose battery powered damper systems controlled by a hand held remote with a long cable from the motor of the damper to a detachable electrical connector (i.e. a mini power jack) for connection to a corresponding detachable electrical connector of the hand held remote. Alternatively, the cable from the motor can be connected to a wall plate having multiple electrical connections at a surface interface, and the detachable electrical connector of the hand held remote is then attached to one of the detachable electrical connectors at the surface interface to control the damper. Use of these types of detachable electrical connectors requires a person to physically plug or unplug the electrical connectors.

[0011] If the hand held remote is connected directly to the motor of the damper, the cable of the remote control will be exposed at the ceiling, wall, vent, etc. to wherever the remote control is stored. This is very unsightly because the cable is visible and hanging from the ceiling, wall, vent, etc. Additionally, exposed cables can also be a potential shock hazard. When operated, the user must be careful not to pull the hand held remote farther than the cable will reach, since this results in the cable being disconnected or torn from the motor. If this happens, the person must reconnect the cable to the motor which can be tedious and time consuming since the motor is located at the damper, which is not easily accessible.

[0012] There are also drawbacks to a system where the cable from the motor is attached to a detachable electrical connection at a surface interface having one or more jacks or outlets, and the other cable from the hand held remote is then attached to the detachable electrical connection at the surface interface to the respective jack or outlet which controls the damper to be adjusted. In this instance, the detachable electrical connection at the surface interface is usually attached at the ceiling, wall, vent etc. Such location is usually at a height where a person cannot reach without the use of an elevating device such as a stepladder, or some type of reaching tool. Once within reach, a cover of the surface interface must be removed in order to grant access to the one or more jacks or outlets. Additionally, if the surface interface includes more than one jack or outlet, the person must determine which jack or outlet controls the damper to be adjusted, which may require consulting with a user manual to properly determine which jack or outlet controls the damper to be adjusted. As noted earlier with respect to systems having mechanically activated dampers, this can cause back strain and presents the danger of falling. Thus, the motorized gear and coupling system dampers also includes problems and safety hazards for a person when adjusting the damper.

[0013] One major disadvantage of all of the above activated radial dampers is that they are only manually controlled by a person. Thus, a person must physically control the opening and closing of the radial damper based on "feel." In other words, the person controls the radial damper based on the temperature that he or she "feels" in the room and is not based on a specific temperature reading according to a thermostat. Thus, these radial dampers according to the prior art are not temperature controlled since there is no temperature reading associated with the adjustment of the radial damper.

[0014] Accordingly, there is a need in the art of damper systems for a device which can control the damper remotely without the use of cables or wires. Additionally, there is a need for a wireless damper system which can be controlled at normal user heights without the need of a step ladder or other similar device. There is also a need for a wireless damper system which can be temperature controlled without the need for a user to physically open or close the radial damper. Such a wireless damper system would utilize a wireless thermostat which is programmable and easily accessible on a wall or other similar surface. A wireless remote control, wireless wand or other wireless remote control device could also be used in place of a thermostat.

[0015] As can be seen from the foregoing, a need exists for a wireless damper system which eliminates the above-mentioned problems, limitations and disadvantages of conventional mechanically activated dampers and conventional motorized gear and coupling dampers. It is to this need that the present invention is directed.

SUMMARY OF THE INVENTION

[0016] As described in the Description of the Prior Art, various types of damper systems are known in the art and can be activated in a number of ways to adjust the damper. Such dampers systems require numerous steps by a user in order to adjust the damper including potential safety hazards to the user.

[0017] An object of the present invention is to provide a wireless damper system which can be remotely operated from virtually anywhere in a home or building.

[0018] Another object of the present invention is to provide a wireless damper system which is easier to install than previous damper systems.

[0019] Still another object of the present invention is to provide a wireless damper system which can control multiple dampers.

[0020] Yet another object of the present invention is to provide a wireless damper system which can be operated from a wireless remote control.

[0021] Another object of the present invention is to provide a wireless damper which is temperature controlled without the need for a user to physically open or close the damper.

[0022] A further object of the present invention is to provide a wireless damper system which can be operated by a wireless thermostat.

[0023] Another object of the present invention is to provide a wireless damper system which does not require the use of an elevating device, or reaching device to adjust the damper.

[0024] Still yet another object of the present invention is to provide a wireless damper system which can be used without requiring access by the user to the damper(s) or items for adjusting the damper(s).

[0025] The foregoing objects are achieved according to the preferred embodiments of the invention by the provision of a wireless damper system which can remotely adjust the damper without the use of cables or wires.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] Other characteristics and advantages of the present invention will emerge from reading the detailed description hereinbelow of nonlimiting embodiments of the invention, and examining the attached drawings wherein:

[0027] FIG. **1**A is a perspective view of a radial damper assembly according to the prior art showing the radial damper blade in a fully open position and a cable running to a panel.

[0028] FIG. **1**B is a perspective view of the damper assembly of FIG. **1**A showing the damper blades in a closed position.

[0029] FIG. **2** is a perspective view of a wired 8-position panel layout according to the prior art showing the connection of a cable.

[0030] FIG. **3** is a perspective view of a single position panel layout according to the prior art showing the connection of a cable.

[0031] FIG. **4** is a perspective view of a wired panel and a hand-held controller according to the prior art showing the cable connection between the same.

[0032] FIG. **5**A is perspective view of a radial damper according to the prior art showing the damper blades in a fully open position and a cable running to a panel.

[0033] FIG. **5**B is a perspective view of the damper assembly of FIG. **5**A showing the damper blades in a fully closed position and a cable running to a panel.

[0034] FIG. **6**A is a perspective view a wireless radial damper according to the present invention showing the damper blades in a fully open position.

[0035] FIG. **6**B is an exploded perspective view of the wireless radial damper of FIG. **6**A showing the various parts of the wireless radial damper.

[0036] FIG. **7**A is a perspective view a wireless radial damper assembly according to the present invention showing the damper blades in a fully open position in a duct.

[0037] FIG. **7**B is a perspective view of the wireless damper assembly of FIG. **7**A showing a wireless thermostat sending a signal to the wireless damper with an electronics cover removed from the damper assembly.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0038] Disclosed according to the present invention is a wireless controlled damper system. The wireless controlled damper system can be operated by a wireless remote control, a wireless thermostat, a wireless wand or any other type of wireless device having means to operate a motor of the damper. In other words, the wireless remote control, the wireless thermostat, the wireless wand, etc. does not have a wire or cable connected directly or indirectly from it to the damper, and specifically to the motor of the damper. Alternatively, the damper assembly can be controlled with a motor which controls a normally wired thermostat or zone control panel.

[0039] With reference to FIGS. **6**A to **7**B, a temperature controlled wireless radial damper system **10** is disclosed. Damper system **10** includes a radial damper **30**, a motor **50**, a receiver **70** and a thermostat **90**. Radial damper **30** includes multiple "bow tie-shaped" blades **32** which rotate about a central shaft **34**. In a fully open position shown in FIG. **7**A with a vertical blade axis, blades **32** are stacked one on top of another. In a fully closed position shown in FIG. **7**B, blades **32** are adjacent each other and not stacked one on top of another. To achieve the fully closed position, each blade **32** rotates one full blade position further than the previous adjacent blade as is known in the art of radial dampers based upon the rotation of central shaft **34**.

[0040] A U-shaped bracket **36** is used for mounting radial damper **30** inside a duct. U-shaped bracket **36** includes a hole **38** in the middle of bracket to allow central shaft **34** to pass therethrough. U-shaped bracket **36** is attached to a round starter collar **40**. The length of U-shaped bracket **36** is approximately the same as the inside diameter of round starter collar **40**. U-shaped bracket **36** attaches to round starter collar **40** using rivets or other known fasteners. Round starter collar **40** (and radial damper **30**) is attached to a duct (not shown) using techniques known in the art such as by riveting.

[0041] After central shaft **34** passes through U-shaped bracket, central shaft **34** connects to motor **50** via a motor shaft **52**. Motor **50** includes motor wires **54** which connect to a receiver **70** as further described below. The motor used with the present invention can include various types of different motors known in the art, and can be synchronous or geared. The motor is typically rated at 24 volt but can also include 120 volt. Although various types of motors are known in the prior art for use with dampers, such dampers are single blade dampers or rectangular dampers where the shaft connected to the blade(s) only needs to rotate 90 degrees to open or close the blades. Therefore, most damper motors known in the art only have a rotation angle of 90 degrees. However, radial dampers require a shaft rotation of 180 degrees to achieve the fully open or fully closed positions. Therefore, motor **50** of the present invention must have a rotation angle of 180 degrees.

[0042] Motor **50** was modified to rotate from 90 degrees to 180 degrees in order to open and close radial damper **30**. The 180 degree rotation is achieved by adjusting the cams inside the motor that activate the "open" or "close" limit switches at the end of the travel (of the cam) which stops the motor. For example, motor **50** could be Model A250-MOC-180 made by eControls, Inc. of Laguna Hills, Calif. Another type of motor that may be used is an econo spring-return motor (not shown). This type of motor includes an automatic spring-return for the damper to return to the fully closed position.

[0043] Although motor **50** in the present embodiment is located inside the duct and thus inside the air stream, it may be preferable for motor **50** to be located outside of the air stream in order to reduce any blockage of air in the duct. If motor **50** is located outside of air stream, a short cable (not shown) will need to connect from motor shaft **54** outside of the duct to central shaft **34** of radial damper **30** inside of the duct. Upon rotation of motor shaft **54**, cable will rotate which in turn will rotate central shaft **34** inside damper assembly **10**.

[0044] Receiver **70** in its preferred form includes a radio frequency ("RF") receiver which is attached to motor **50** by motor wires **54** as shown in FIGS. **7**A-**7**B. RF receivers are well known in the art and various types can be used with the present invention. RF receivers pick up an RF signal or radio wave from an RF remote control and convert it to an electrical signal. The electrical signal then runs through wires and a connecting block, to radio frequency emitters (RF emitter) that reproduce the original radio frequency remote control signal. When the RF remote control signal is received by the RF receiver **70**, motor **50** of radial damper **30** is activated to control the position of damper blades **32**. The RF remote control signal is advantageous because walls, corners, etc. do not impede the transmission of the radio waves.

[0045] The RF remote control signal according to the preferred embodiment has a range of roughly 100 feet. In other words, the wireless remote control does not have to be in the line-of-sight of the RF receiver of the damper system. Therefore, a user can control the operation of the damper assembly without connection between the wireless remote control and the RF receiver. Thus, the remote radio frequency control could be around a corner, in a different room or even a different floor. In the alternative, other types of signals can be used besides RF signals. For example, an infrared (("IR") signal and others known in the art could be used as well. However, an IR signal usually does not have the range of an RF signal and the IR signal of the IR remote control must be in the line of sight of the IR motor control. Therefore, an RF signal is preferred.

[0046] In the present embodiment, the RF remote control is thermostat **90** as shown in FIG. **7**B. Thermostat **90** is adjustable and programmable to control the temperature of a home, office room or building through a heating ventilation and air conditioning (HVAC) system such as a furnace, boiler, air conditioner, etc. as is known in the art. Thermostat **90** includes an RF emitter (not shown) which sends an RF signal to receiver **70** when the HVAC system turns on and off based on the programmed temperature of the thermometer inside thermostat **90**. When receiver **70** receives the RF signal, motor **50** operates to rotate central shaft **34** which activates the opening or closing of radial blades **32** of damper **30**. Therefore, damper system **10** is temperature controlled since it automatically adjusts damper **30** to a fully open position, a fully closed position, or some position between the fully open and fully closed positions. Of course damper system **10** can also be controlled based on a user using a portable RF remote controller or by manually adjusting the temperature setting on thermostat **90**.

[0047] Receiver **70** can be mounted in a number of different places near the damper assembly, and is preferably located outside of the airstream and therefore on the outside of damper assembly **10**. As shown in FIG. **7**A, receiver **70** is mounted to the damper assembly **10** using a bracket or "take-off" **80** known in the art. Such take-offs are manufactured by Duratite and Acitvent and can be made from a number of materials including plastic and galvanized steel. Take-off **80** is mounted to the outside of round starter collar **40** using fasteners known in the art such as rivets (not shown). Additional fasteners, such as screws (not shown), are used to mount receiver **70** to take-off **80**.

[0048] Receiver **70** is not limited to any specific location with respect to damper assembly **10**. Receiver **70** may be connected to the same power source or transformer for motor **50** of damper assembly **10**. Thus, the wires from the receiver **70** and to motor **50** can come from the same transformer (not shown). Both receiver **70** and motor **50** typically require 24 volts and are considered to be of low amperage. Therefore, the transformer could easily supply power for multiple units, i.e. more than one motor **50** and receiver **70** for additional dampers.

[0049] The present invention can also be used with a zone control panel for controlling multiple radial dampers in multiple rooms (i.e. zones) of a home or building. In this scenario, multiple receivers are wired in parallel or in series together in order to communicate with a single thermostat. If different temperatures are desired in the different rooms or zones, an additional thermostat is installed in each room or zone. Therefore, the radial damper in one zone is controlled by a desired temperature and the radial damper in another zone is controlled by a different desired temperature. Thus, a zone controlled system allows for the independent adjustment of the temperature in each zone.

[0050] In another possible embodiment of the present invention not shown, a wireless remote control, a wireless wand or any other type of wireless device could be used in place of thermostat **70**. The wireless remote control, wireless wand or other type of wireless device would function in a similar manner as thermostat **70**. That is, wireless remote control, wireless wand or other type of wireless device would include an RF emitter which would send an RF signal from the wireless remote control, a wireless wand, or other wireless device to receiver **70**, and the damper system would operate in the same manner as previously discussed.

[0051] Thermostat **70** or wireless remote control, wireless wand, or other wireless can display additional information other than temperature, such as battery life, identification of the damper being controlled, the position of the dampers relative to the fully open/closed position, and other information. To accommodate these additional features, thermostat **70** or wireless remote control, wireless wand, or other wireless may be provided with a visual or audible display. Thermostat **70** or wireless remote control, wireless wand, or other wireless may also include a memory to store data.

[0052] Having described the invention, it will be apparent to those skilled in the art that alterations and modifications may be made without departing from the spirit and scope of the invention limited only by the appended claims.

I claim:

1. A wireless radial damper system for use with a duct having an air inlet and air outlet inside the duct, said wireless radial damper system comprising:

at least one radial damper including a central shaft and radial blades operatively connected to said central shaft,

said radial blades being movable between an open position for opening the air inlet and air outlet, and a closed position for closing the air inlet and air outlet;

a motor operatively connected to said central shaft for moving said radial blades between the open position, the closed position or a position between the open and closed positions;

a receiver operatively connected to said motor for receiving a wireless signal to control said motor; and

a programmable wireless thermostat for selectively transmitting the wireless signal to said receiver,

wherein said radial damper system is capable of being temperature controlled based on the programming of said wireless thermostat.

2. A wireless radial damper system according to claim **1**, wherein said motor is an econo spring return motor.

3. A wireless radial damper system according to claim **1**, wherein said motor is located within the air inlet and outlet of the duct.

4. A wireless radial damper system according to claim **1**, wherein said motor is located outside of the air inlet and outlet of the duct.

5. A wireless radial damper system according to claim **1** and further comprising a take off operatively connected to the outside of the duct for mounting said receiver outside of the duct.

6. A wireless radial damper system according to claim **4** and further comprising a cable connected from said motor outside of the duct to said central shaft inside of the duct.

7. A wireless radial damper system according to claim **1** wherein said motor has a rotation angle of 180 degrees.

8. A wireless radial damper system according to claim **1** wherein said thermostat is a wireless remote controller.

9. A wireless radial damper system according to claim **1** wherein said thermostat is a wireless wand.

* * * * *