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Cunningham et al.

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(54) **CENTRAL VACUUM CONTROL UNIT**

(75) Inventors: **J. Vern Cunningham**, Aurora (CA); **Mircea Dan Paul**, Richmond Hill (CA); **Daniel Budurea**, Mississauga (CA)

(73) Assignee: **CUBE INVESTMENTS LIMITED**, Auror, ON (CA)

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PCT Pub. Date: **May 5, 2011**

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A47L 5/12 (2006.01)
A47L 9/28 (2006.01)

(52) **U.S. Cl.**

CPC ... ***A47L 5/38*** (2013.01); ***A47L 5/12*** (2013.01); ***A47L 9/2842*** (2013.01); ***A47L 9/2857*** (2013.01); ***A47L 9/2894*** (2013.01)

(58) **Field of Classification Search**

CPC A47L 5/38; A47L 9/28; A47L 5/12; A47L 9/2842; A47L 9/2857; B08B 15/002; B65H 2701/33; D01H 11/005; B23Q 11/0046

USPC 15/301–319, 413

See application file for complete search history.

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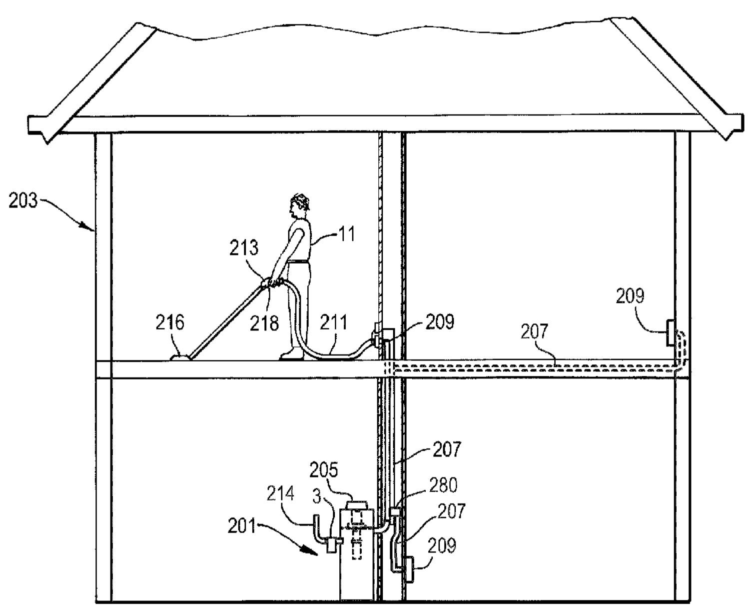
Primary Examiner — Robert Scruggs

(57) **ABSTRACT**

A central vacuum cleaning system can include a vacuum unit, a plurality of inlet valves, an exhaust, a cleaning air path from the inlet valves through the vacuum unit to the exhaust, and a control unit. An example control unit can include a power input, a power output, motor control circuitry to control application of power from the power input to the power output, a first port, a second port, a conduit providing a conduit air path between the first port and the second, a heat sink in thermal contact with the conduit air path and a component of the motor control circuitry, wherein the control unit is connected through the first port and the second port in the cleaning air flow path between the inlets and the exhaust, and the power output is connected to a power input of the vacuum unit.

18 Claims, 7 Drawing Sheets



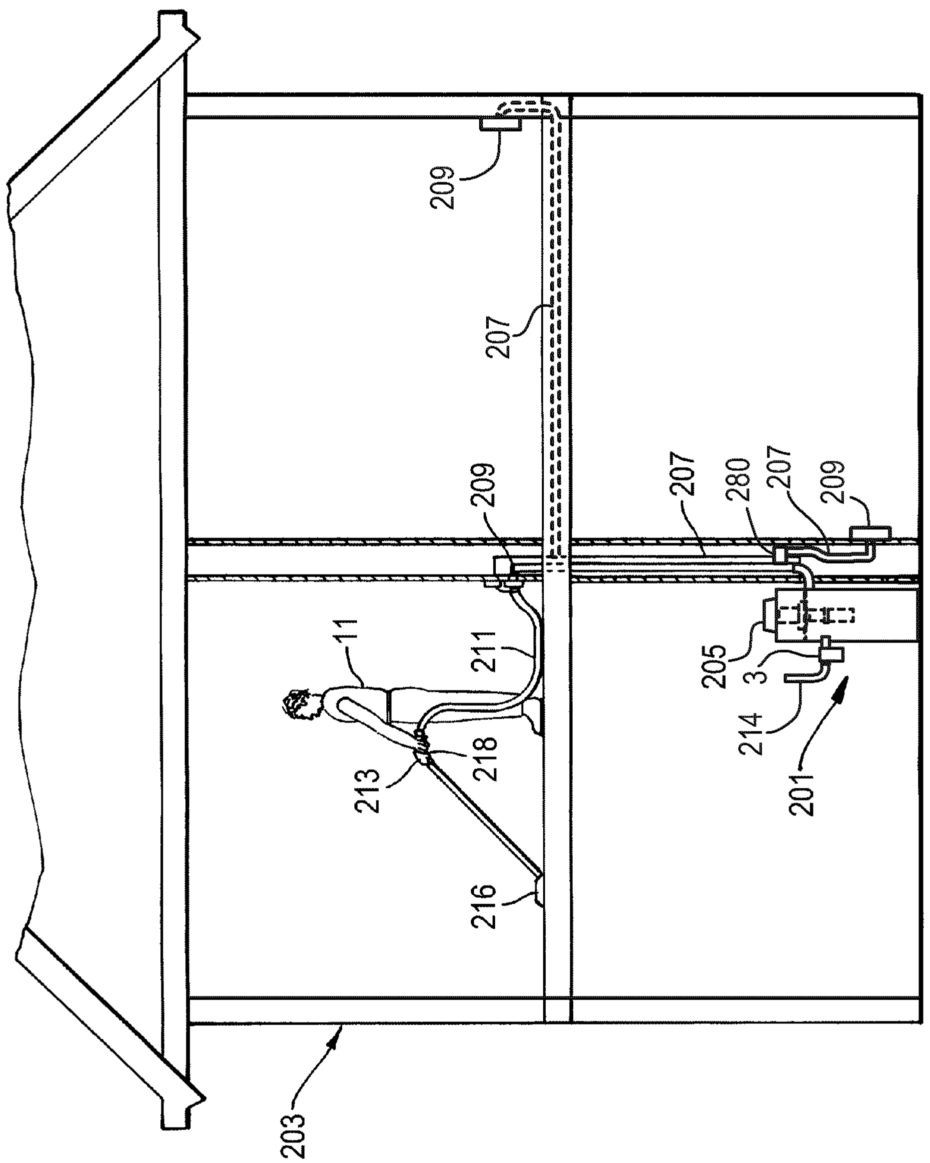


FIG. 1

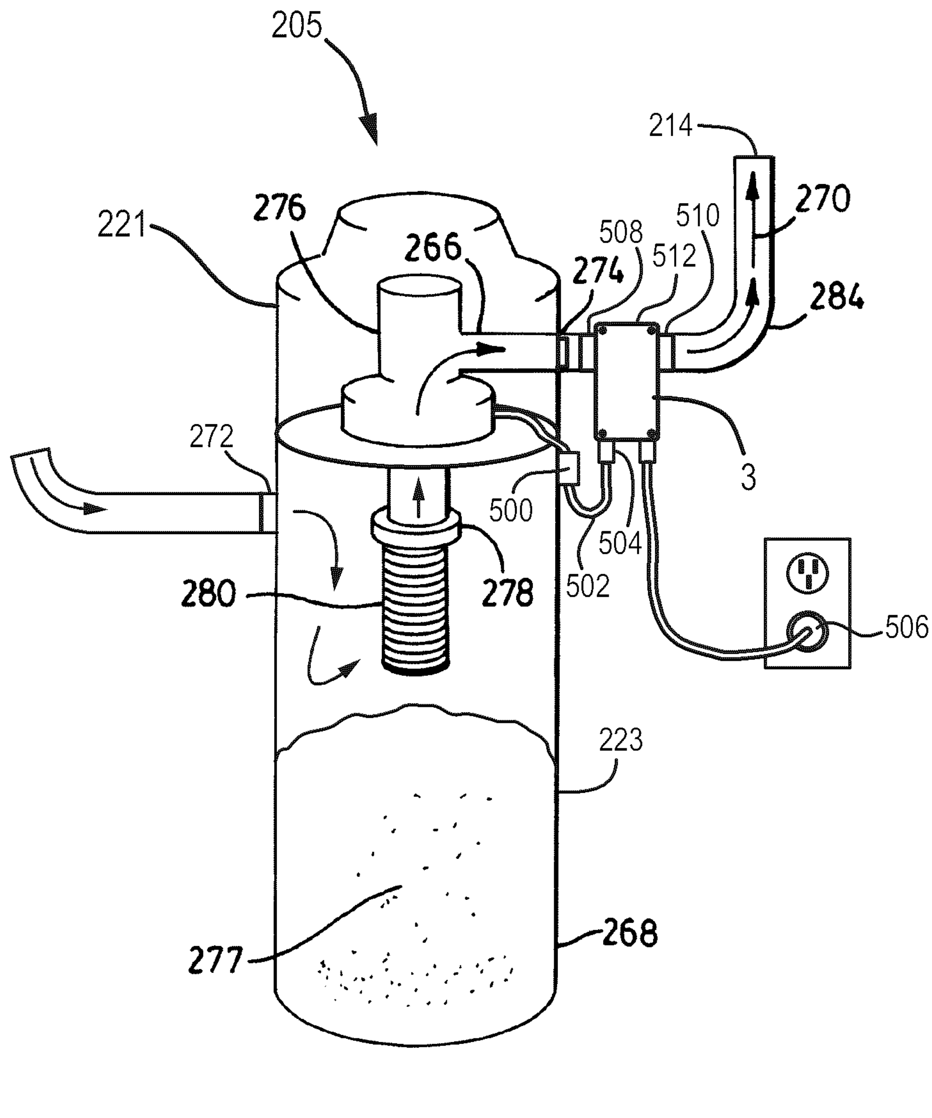

205
214
270
221
276
266
508
510
274
512
284
3
272
500
504
280
278
502
506
223
277
268

FIG. 2

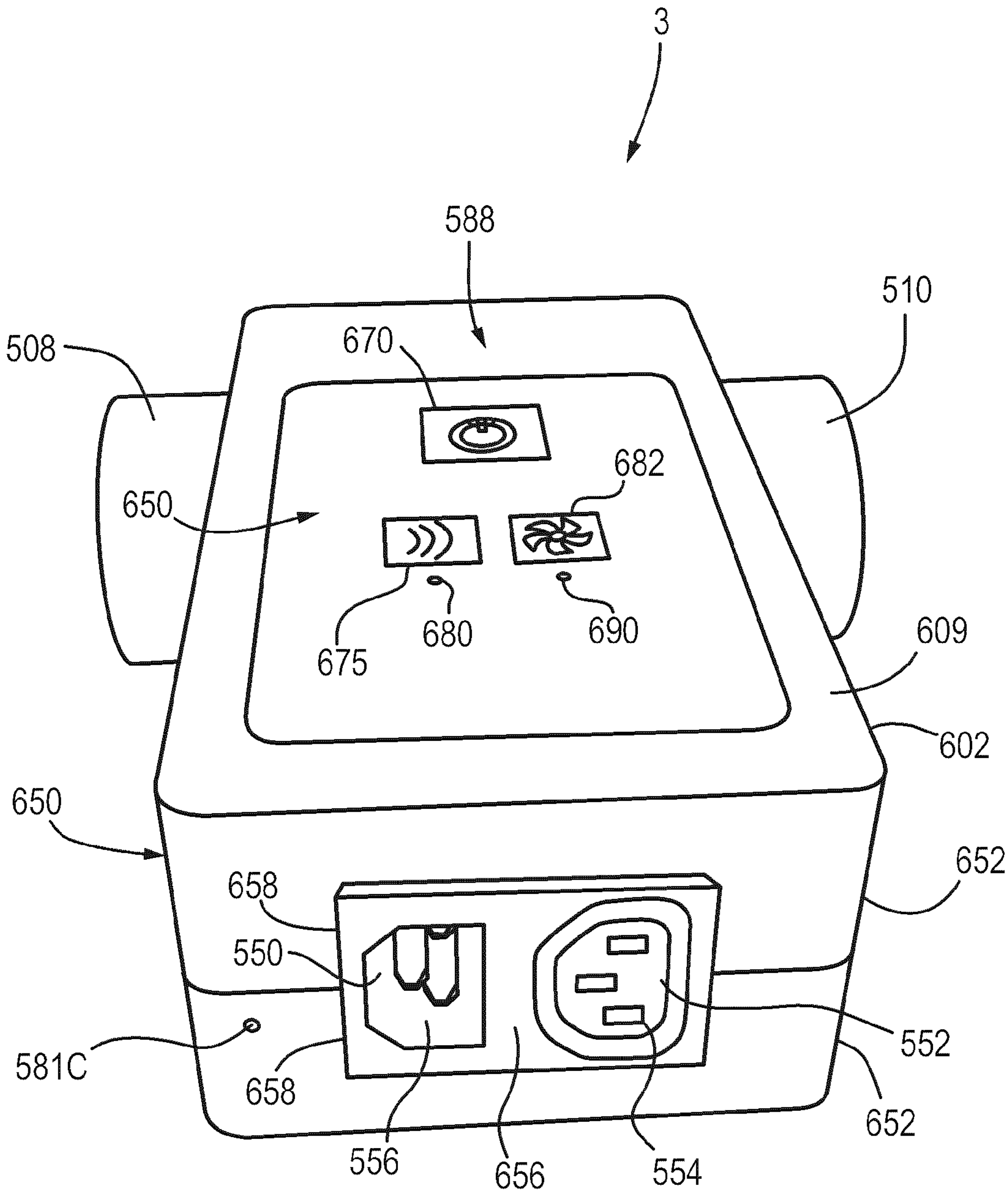

3
588
510
508
670
682
650
675
680
690
609
602
650
652
658
550
552
581C
658
652
556
656
554

FIG. 3

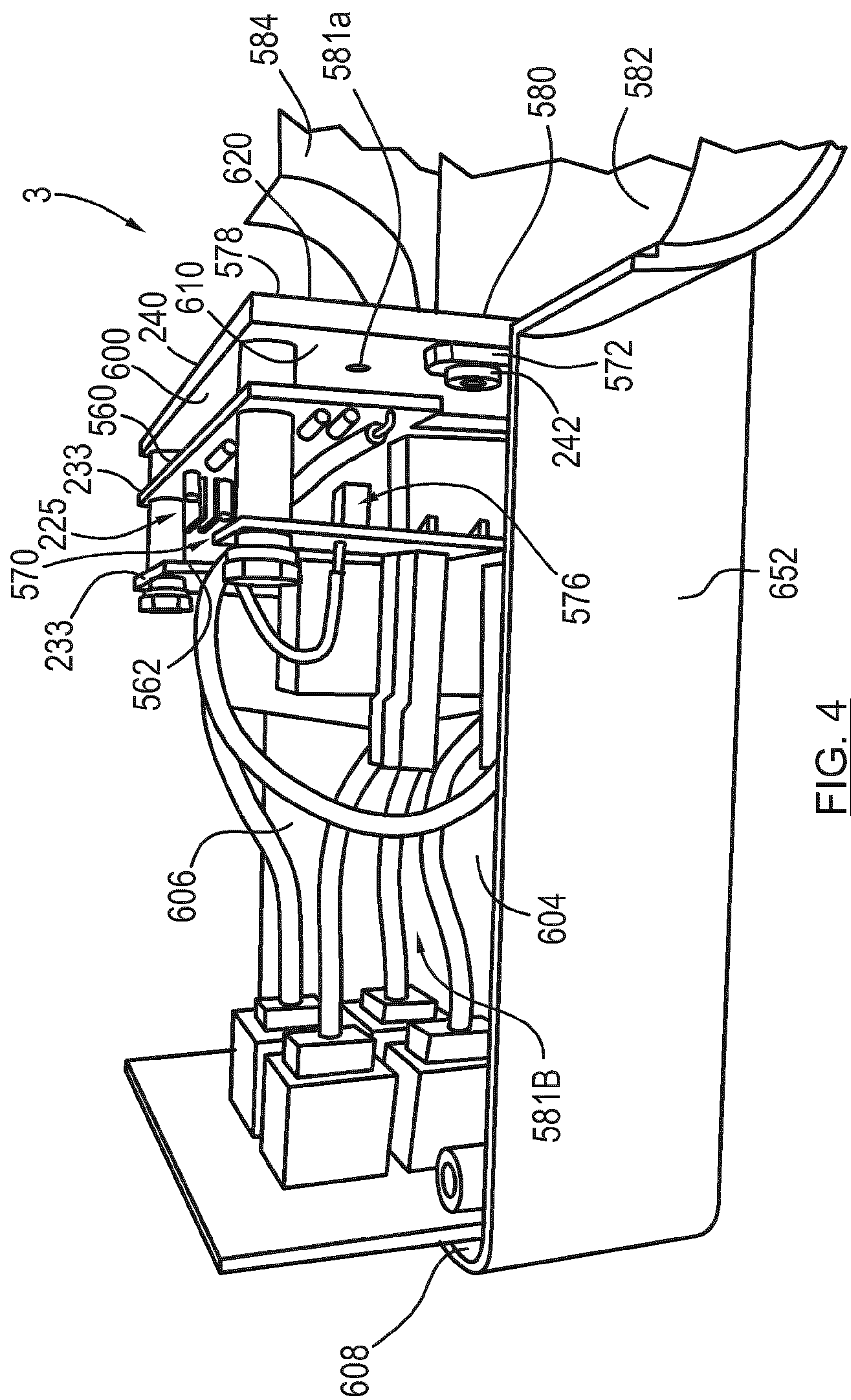

3
584
581a
620
578
610
240
600
560
233
225
570
233
562
580
582
572
242
576
652
606
604
581B
608

FIG. 4

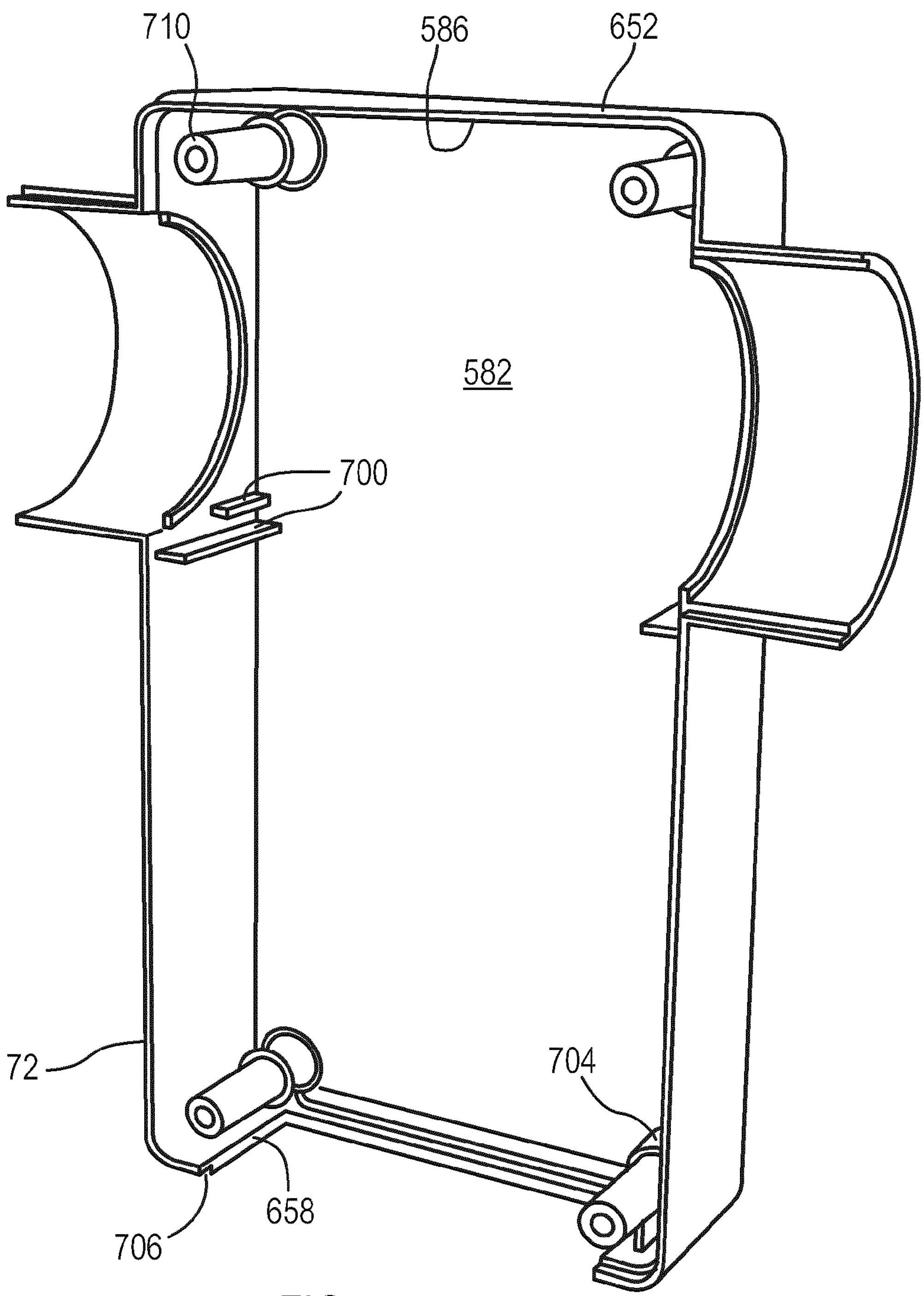


FIG. 5

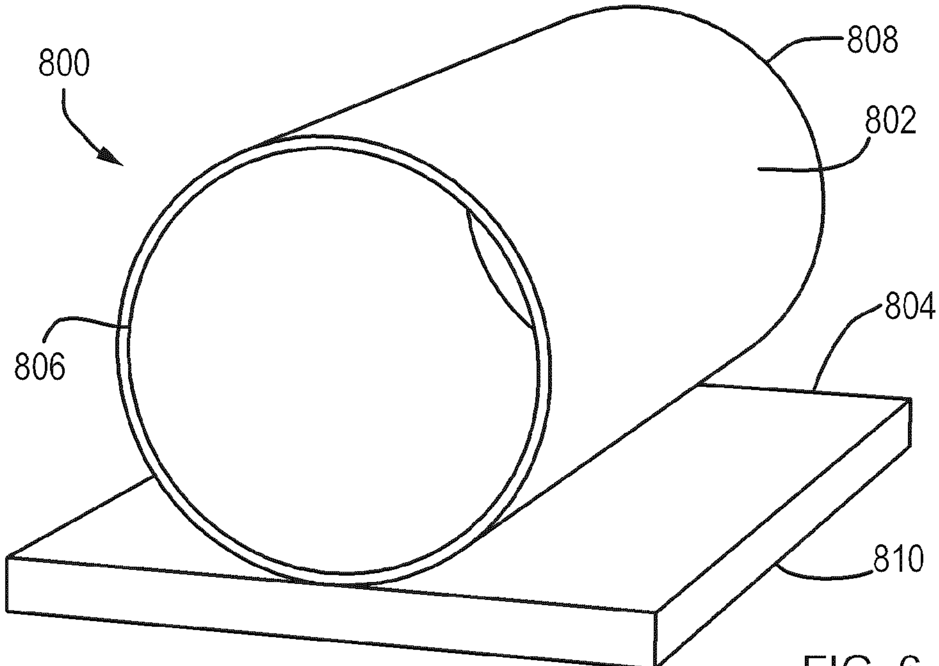


FIG. 6

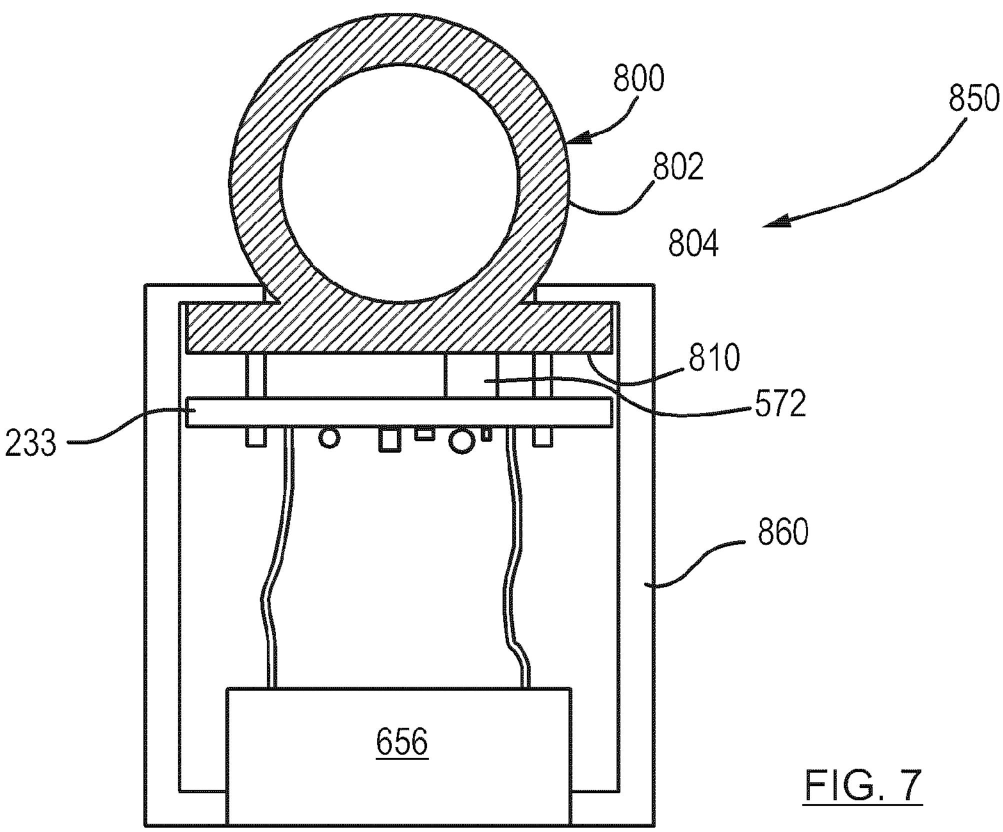


FIG. 7

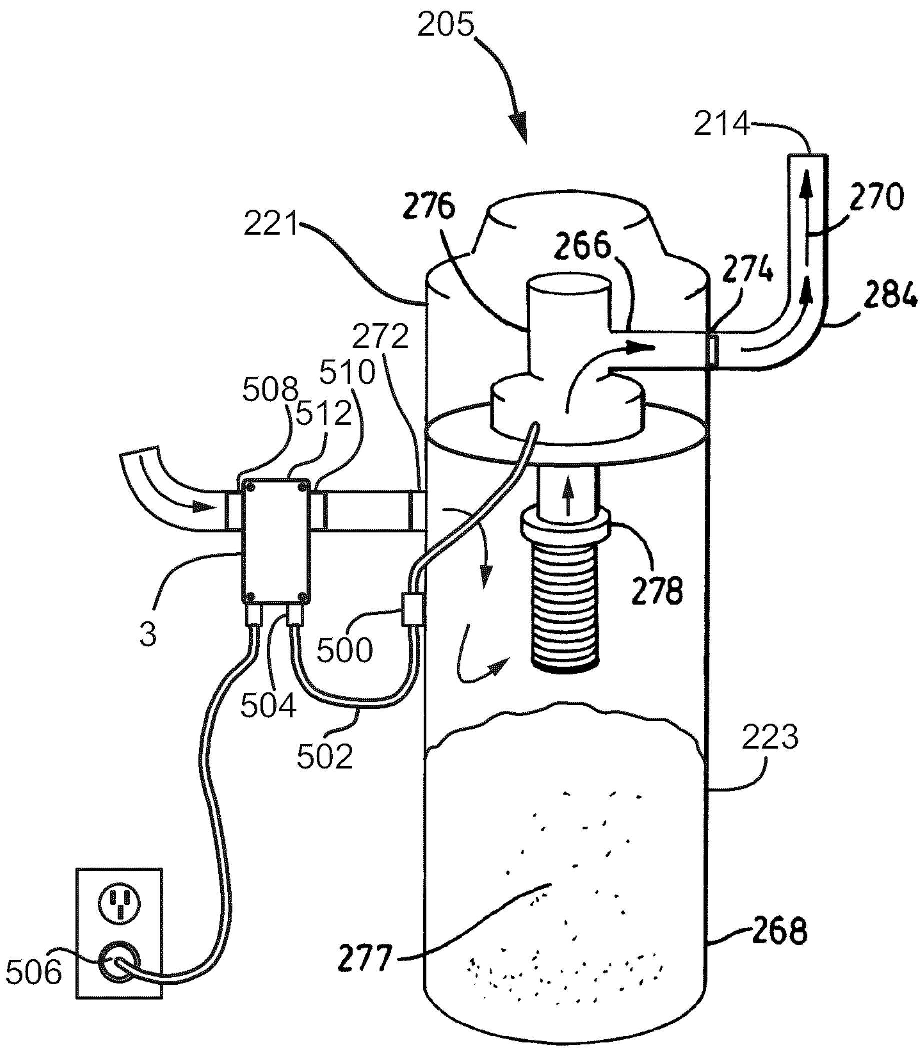

205
214
276
270
221
266
274
284
272
510
508
512
3
278
500
504
502
223
506
277
268

FIG. 8

CENTRAL VACUUM CONTROL UNIT

CROSS-REFERENCE TO OTHER APPLICATIONS

This application claims priority from and the benefit of the filing date of U.S. Provisional Patent Application 61/256,708 filed Oct. 30, 2009 under title CENTRAL VACUUM CONTROL UNIT. The content of the above application is hereby incorporated by reference into the detailed description hereof.

FIELD

This description is related to the general field of central vacuum system components.

BACKGROUND

Many modern buildings have central vacuum cleaning systems. These systems have a vacuum unit incorporating a suction motor and impeller to create a vacuum in piping through the building. A user of the system connects a flexible hose to the piping. The hose has a handle for the operator to grasp. The handle is further connected to one or more cleaning accessories.

The motor is housed in a motor housing that typically forms part of a central vacuum unit, often referred to as a "central vacuum power unit". The vacuum unit also has a receptacle portion for receiving dust and other particles picked up through the cleaning accessories and transported by airflow generated by the vacuum unit through the hose and piping.

The vacuum unit is usually placed in a central location that is easily accessible for emptying the receptacle. The motor is typically powered by line voltage that is controlled by a motor control circuit in the motor housing.

Low voltage wires typically run beside, or form part of, the piping and hose between the canister and the handle. This permits the operator to control the motor by sending low voltage signals from the handle to the motor control circuit. In order to receive the low voltage signals, an opening is provided in the motor housing through which the low voltage wires can be connected to the motor control circuit.

Improvements to, or alternatives for, components in central vacuum cleaner systems, and methods related thereto, are desirable.

BRIEF DESCRIPTION OF DRAWINGS

For a better understanding of the present embodiments and to show more clearly how the embodiments may be carried into effect, reference will now be made, by way of example, to the accompanying drawings that show the preferred embodiment of the present invention and in which:

FIG. **1** is a cross-section of a building incorporating an example implementation of a central vacuum cleaning system,

FIG. **2** is a perspective view of an example implementation of a vacuum unit and control unit assembly for use in the cleaning system of FIG. **1**, the assembly incorporating an example implementation of a control unit and the vacuum unit shown in partial cut-away,

FIG. **3** is perspective view of the control unit of FIG. **2**,

FIG. **4** is a perspective cut-away view from one side and slightly in front of the control unit of FIG. **2**,

FIG. **5** is a perspective cut-away view from above, to one side, and slightly above an example implementation of a control unit housing for the control unit of FIG. **2**,

FIG. **6** is a perspective view of an example alternative conduit heat sink for use in an example alternative implementation of a control unit for the system of FIG. **1**,

FIG. **7** is a cross-section of an example alternative control unit employing the heat sink of FIG. **6**, and

FIG. **8** is a perspective view of an example implementation of a vacuum unit and control unit assembly similar to the assembly of FIG. **2**, but with the control unit in a dirty air path.

DETAILED DESCRIPTION

It is to be noted that numerous components are similar for different embodiments described herein, and components from one embodiment can be used on other embodiments. The description for similar components in different embodiments applies equally to all embodiments unless the context specifically requires otherwise. Components from one embodiment can be applied to other embodiments unless the context specifically requires otherwise, and specific reference to the cross-application of such components will not be made for each embodiment, but is expressly stated hereby.

Terms of orientation, such as top, bottom, front, rear, side, are used in the description. Terms of orientation are used for ease of understanding of the concepts being described. It is understood that in practice the structures described herein can take on alternate orientations.

Various example aspects and various example implementations of aspects of central vacuum cleaning system and elements of such systems will be described herein. For example an example central vacuum cleaning system can include a vacuum unit, a plurality of inlet valves, an exhaust, a cleaning air path from the inlet valves through the vacuum unit to the exhaust, and a control unit. An example control unit can include a power input, a power output, motor control circuitry to control application of power from the power input to the power output, a first port, a second port, a conduit providing a conduit air path between the first port and the second, a heat sink in thermal contact with the conduit air path and a component of the motor control circuitry, wherein the control unit is connected through the first port and the second port in the cleaning air flow path between one of the plurality of inlet valves and the exhaust, and the power output is connected to a power input of the vacuum unit.

The control unit can be connected in the cleaning air path between the vacuum unit and the inlet valves in air flow communication with all inlet valves. The control unit can be connected in the cleaning air path between the vacuum unit and the exhaust.

The system can have central vacuum cleaning system piping between the inlet valves and the vacuum unit, and between the vacuum unit and the exhaust. The piping can provide a portion of the cleaning air path, and the first port and second port can be piping ports connected to the piping.

In operation, an example implementation can provide cooling of motor control circuitry in a central vacuum cleaning system by generating a vacuum to create air flow in a cleaning air path from one of a plurality of inlet valves through a vacuum unit to an exhaust, wherein the cleaning air path includes a control unit connected between one of the plurality of inlet valves and the exhaust and the control unit including a power input, a power output, motor control circuitry to control application of power from the power input to the power output, a first port, a second port, a conduit providing a conduit air path between the first port and the second, a heat sink in thermal contact with the conduit air path and a component of the motor control circuitry.

Other aspects and implementations of aspects will be evident from the detailed description herein.

Referring to FIG. **1**, a central vacuum cleaning system (indicated generally at **201**) incorporates a control unit **3**. The system **201** is installed in a building **203**. The building **203** is shown as a residence; however, the system **201** could be installed in other buildings, such as commercial or industrial buildings.

The system **201** has a vacuum unit **205** in the building **203**. The vacuum unit **205** is connected through piping **207** in walls, floors or ceilings of the building **203**. Alternatively, the piping **207** may be exposed. The piping **207** terminates at inlet valves **209** to which a flexible hose **211** may be connected. The hose **211** terminates in a handle **213** that is held by an operator **11**. Various cleaning attachments, such as a carpet brush **216**, are connected to the handle **213**.

Control signals, such as ON/OFF, from the operator **11** to the control unit **3** are provided through a user interface **218** in the handle **213**. The user interface **218** can be a simple switch. More sophisticated systems **201** can utilize more sophisticated control signals for many other purposes, such as duplex communications that allow the receipt of information at the handle **213**. Such information could be used to drive LEDs, an LCD screen, or other display means as part of the user interface **218**.

When the operator **11** turns on the system **201**, a vacuum created by the vacuum unit **205** draws cleaning air through a cleaning air path including the attachment **216**, handle **213**, hose **211**, piping **207**, the vacuum unit **205**, and exhausts the cleaning air to the environment through exhaust **214**. The exhaust **214** may terminate inside or outside the building **203**. The exhaust **214** can include a muffler, not shown, to dampen noise. The exhaust **214** can include a terminating vent, not shown, for outdoor termination applications.

Referring to FIG. **2**, the vacuum unit **205** has a suction motor **276** (a combination of a motor and an impeller, not separately shown) within a motor housing **221** (typically an upper portion of the vacuum unit **205**). Extending from the motor housing **221** is a receptacle **223** (typically a lower portion of the vacuum unit **205**) for receiving dirt **277**.

The vacuum unit **205**, driven by the suction motor **276**, generates a vacuum to create air flow in a cleaning air path through the vacuum unit **205** as illustrated by arrows **270**. Cleaning air is distinct from motor cooling air. A motor cooling air path, not shown, is typically also provided within the vacuum unit **205** to provide cooling air to the motor **276**. Incoming motor cooling air is drawn from the environment around the vacuum unit **205**. The vacuum unit **205** can mix exhaust cleaning air and motor cooling air together or, alternatively, motor cooling air and cleaning air can be exhausted separately. For the purposes of this description the cleaning air path is that portion of an air path that contains cleaning air whether or not the air flow path also contains motor cooling air.

The cleaning air is divided from dirt **277** within the vacuum unit **205**. For example, the vacuum unit **205** can provide a coarse dust separator **280** followed by a finer filter **278** in the cleaning air path **270** within the vacuum unit **205** over the dirt receptacle **223** and prior to motor **276**. When cleaning air ceases to flow in the cleaning air path **270**, for example because the vacuum unit **205** has been turned off, the dirt **277** falls from the dust separator **280** and filter **278** into the dirt receptacle **223** to the extent the dirt **277** have not already fallen into the dirt receptacle **223**. Filtering the dirt **277** can assist in reducing wear on the motor **276**. Other methods of dividing dirt from cleaning air into a dirt receptacle are known in the central vacuum cleaning system art. The methods and systems described herein are applicable to such methods of dividing dirt from cleaning air within a central vacuum cleaning system vacuum unit.

That part of the cleaning air path **270** prior to the vacuum unit **205** contains dirty cleaning air and is a dirty cleaning air path. That part of the cleaning air path **270** after the vacuum unit **205** contains cleaning air exhausted from the motor **276** and is an exhaust cleaning air path.

The vacuum unit **205** has an inlet port **272** through which dirty cleaning air is received and an exhaust port **274** through which exhaust cleaning air is exhausted. The inlet port **272** can be a piping port such that inlet port **272** is dimensioned to receive piping **207**. The exhaust port **274** can similarly be a piping port such that exhaust port **274** is dimensioned to receive piping **207**. Typically, for residential uses central vacuum cleaner piping is tubular PVC conduit of approximately two inch internal diameter. Other sizes and materials may be used.

The control unit **3** is mounted outside the vacuum unit **205**. The control unit **3** is mounted in the cleaning air path **270** in air flow communication with all inlet valves **209**. Air flow communication to all inlet valves **209** requires that the control unit **3** be located in the cleaning air flow path **270** such that when the vacuum unit **205** is drawing suction then air flows through the control unit **3** from any inlet valve **209** in use. Thus, the control unit **3** is between the vacuum unit **205** and a first branching **280** of the piping **7** between two inlet valves **209**.

The control unit **3** is preferably located adjacent the vacuum unit **205** such that the control unit **3** can be electrically connected to a motor power input **500** of the vacuum unit **205** to control the provision of power for the motor **276**. Typically a motor power input **500** of the vacuum unit **205** is provided by way of a power cord **502** terminating in a male plug **504** that would otherwise be connected to mains power **7**, for example through an electrical receptacle **506**. The motor power input **500** is connected to the control unit **3** rather than the receptacle **506**. The main power **7** is typically line voltage, for example, 120V or 240V, 60 Hz AC in North America or 230V, 50 Hz AC in Europe.

Further, the control unit **3** can be located in the same space as the vacuum unit **205** such that the control unit **3** is accessible when installing and maintaining the vacuum unit **205**.

Referring to FIGS. **2** and **3**, the control unit **3** includes opposing ports **508**, **510** at either end of a conduit **512** such that the control unit **3** can be connected to the cleaning air path **270** at the ports **508**, **510** and through the conduit **512** to form part of the cleaning air path **270**. As shown in the FIGS. the ports **508**, **510** are piping ports that are dimensioned to receive central vacuum cleaning system piping **207**.

The location of the control unit **3** between portions of piping in the central vacuum cleaner system **201** can considerably ease installation, particularly in retrofit applications. The piping **207** can be cut to create two opposing piping ends, the control unit **3** is then simply inserted between and attached at the ports **508**, **510** to the created piping ends. Pre-existing motor control circuitry within the vacuum unit **205** can be removed or bypassed. As an example bypass, if the vacuum unit **205** has existing wired communication control circuitry with a relay module, not shown, then existing low voltage control wire connections to the vacuum unit **205** can be shorted (equivalent to an “ON” signal).

Due to the operation of relays it may be required to operate initially at full power in order to turn on the relay. Accordingly, when an “ON” signal is received by the control unit **3** then full power is provided by the control unit **3** to the vacuum unit **205** from the source of mains power, receptacle **506**. It has been found that three AC cycles is typically enough time to turn the relay on. Any motor soft start routine in the control unit **3** can then be run by first dropping the voltage, followed by slowly ramping up to full voltage.

Although not shown in the FIGS., one of the ports **508** or **510** can be formed together with a port **272** or **274** of the vacuum unit **205** such that piping **207** is not required between the vacuum unit **205** and the control unit **3**.

Referring to FIG. **3**, the control unit **3** has a power input **550** and a power output **552**. The power output **552** can be electrically connected to the motor power input **500**. The power output **552** can be an electrical receptacle **554** such as a female receptacle **554** to receive prongs of the plug **504**. Other structures to electrically connect the motor power input **500** and the power output **552** will be evident to those skilled in the art, such as for example direct wiring from the vacuum unit **205** to the control unit **3**.

The power input **550** can be electrically connected to a source of mains power, such as for example receptacle **506**. The power input **550** can be an electrical receptacle **556** such as a male receptacle **556** to receive a female end of a male/female cord, not shown, for connection from the receptacle **556** to the receptacle **506**. Other structures to electrically connect the power input **550** to mains power will be evident to those skilled in the art, such as for example a cord wired to the control unit **3**.

Referring to FIG. **4**, the control unit **3** includes motor control circuitry **225**. As described later below, the control unit has two covers **652**. For clarity, one cover has been removed from the control unit **3** and is not shown in FIG. **4**. The motor control circuit **225** can be laid out on one or more printed circuit boards **233**, including all of the components (indicated generally at **570**) to implement the functions of the control unit **3**. Multiple printed circuit boards or separately mounted components may be used as desired. In FIG. **4**, two printed circuit boards **233** are stacked one on top of the other. For example, one board **560** can provide some control functions, while another board **562** provides electromagnetic interference (EMI) suppression circuitry.

The motor control circuitry **225** includes one or more components, such as component **572**, that generate heat. Heat generated by the circuitry **225** can affect the proper operation of the circuitry **225**, including for example component **572**. A heat sink **240** is provided to assist in cooling the circuitry **225**. One or more components **570**, such as component **572**, are placed in thermal contact with the heat sink **240** to provide a thermal conduction path to conduct heat away from the circuitry **570**, and in particular from the component **572**. Thermal contact can be achieved by placing one or more components **570**, such as component **572**, in physical contact with the heat sink **240**. Thermal conduction paste can be used to assist in conducting heat between the component **570** and the heat sink. The component can be attached to the heat sink to prevent movement between the component **570** and the heat sink **240**. Alternative methods can be used to fix a component **570** to the heat **240** and providing thermal conduction, for example, by soldering or applying a thermally conductive glue.

As an example the component **572** can be a triac to control the supply of power from the power input **550** to the power output **552**, and, thus, control the supply of power from the receptacle **506** to the vacuum unit **205**. The component **572** can be placed in physical contact with the heat sink **240** and fixed to the heat sink **240** using a screw **242**.

Although a printed circuit board embodiment is shown in the FIGS. it is recognized that all or part of the motor control circuitry **225** can be provided in dependently of a circuit board. For example, the component **572** can be fixed to the heat sink and electrically connected by wires, not shown, to the remainder of the circuitry **225** on a printed circuit board.

The motor control circuitry **225** includes a communication module **576** within the components **570** to receive control signals from a remote control unit. In the example provided in the FIGS. the communication module **576** is a wireless communication module for receiving control signals from a remote control unit, such as handle **213** incorporating user interface **218** and a wireless communication module similar to the communication module **576**. Alternatively, the communication module **576** can receive control signals from a wired connection. In this case, control inputs, not shown, can be provided on the control unit **3**, such control inputs to be connected to control wires between the control unit **3** and the handle **213**. Many examples of motor control circuitry including communication between a handle and a vacuum unit are known in the art, see for example, U.S. Pat. No. 7,403,360 issued Jul. 22, 2008 to J. Vern Cunningham which describes both wired and wireless communication in central vacuum cleaning systems.

The control unit **3** can also communicate with other devices, not shown, such as a remote station or other appliances. An example of wireless communication between a central vacuum cleaning system communication module and a remote station is described in the above US patent. An example of wireless communication between a central vacuum cleaning system communication module and other appliances is described in US Patent Publication Number 2007/0079467 A1 of J. Vern Cunningham published Apr. 12, 2007.

The heat sink **240** forms a surface **578** of the conduit **512** such that the heat sink **240** is in thermal contact with the cleaning air path **270**. Air flow in the cleaning air path **270** during operation of the system **201** when the suction motor **276** is running will carry heat away from the heat sink **240** to cool the component **572**.

For additional cooling a small aperture **581***a* could be provided in the heat sink **240** to connect housing chamber **581***b* inside the housing **602** to the cleaning air path **270** within the conduit **512**. The aperture **581***a* acts as a venturi when air is flowing in the cleaning air path **270** during operation of the system **201** such that air is drawn from the chamber **581***b* into the conduit **512** and the cleaning air path **270**. If the housing chamber **581***b* is tightly sealed a further aperture **581***c* (see FIG. **3**) can be provided to allow air to be drawn into the chamber **581***b* from the surrounding environment as air is drawn from the chamber **581***b* through the aperture **581***a*.

As shown in FIG. **4**, the heat sink **240** forms part of a lower wall **580** of the conduit **512**. Other surfaces of the conduit **512** include rear wall **582**, side walls **584**, top wall **586**, and front wall **588**, not shown in FIG. **4** but the back of the front wall **588** is evident in FIG. **3**.

The heat sink also forms a surface of an upper wall **600** of a motor control housing **602**. Other surfaces of the housing **602** include rear wall **604**, side walls **606**, bottom wall **608**, and front wall **609**, not shown in FIG. **4** but the back of front wall **609** is evident in FIG. **3**. The motor control circuitry **225** is housed by the motor control housing **602**.

As shown in the FIGS. the heat sink **240** has a flat planar surface **610** forming the upper wall **600**. This is advantageous as circuitry **225** that requires heat sinking is often provided in the form of an integrated circuit package have a flat planar thermal contact surface. Also, the heat sink **240** can be easily manufactured from a piece of sheet material, such as an aluminum sheet. Other thermally conductive materials can be used for the heat sink.

Surface **620** of the heat sink **240** is a flat plane surface. The surface **620** is in contact with the cleaning air path **270** at a radius from a longitudinal axis of the conduit **512** that is equal to or greater than the radius of the cleaning air path **270** outside and adjacent the control unit **205** (typically the diameter of piping **207**) to provide sufficient thermal contact and avoid reducing air flow within the cleaning air path **270**.

The conduit **512** has a cuboid shape to accommodate the heat sink **240** and for ease of manufacturing. It is recognized that the conduit **512** can take alternate shapes. For example, the conduit **512** could have a combination of curved surfaces and flat plane surfaces, such as a tube bisected, in half or otherwise, by a flat plane parallel to the longitudinal axis of the tube and completed by a flat plane surface **620** of the heat sink **240**. The tube could be bisected along the length of the conduit **512**, or only in part such that the heat sink is inserted into an opening in the tube. As a further example, the entire conduit **512** could be tubular with the surface **620** being a curved plane forming a curved surface of the tubular conduit. A tubular conduit heat sink embodiment is described later with reference to FIGS. **6** and **7**. Use of a partial tubular conduit can require an increase of the radius of the tube to provide sufficient thermal contact while avoiding reduction in air flow within the cleaning air path **270**.

Referring to FIG. **3**, the conduit **512**, ports **508**, **510** and motor control housing **602** are provided by a unitary vacuum control unit housing **650**. For ease of manufacture and assembly, the housing **650** is made up of two opposing housing covers **652** and a receptacle plate **656**. An opening **658** is provided in each cover through which the receptacle plate **656** is accessible. The receptacle plate **656** includes the receptacles **554**, **556**.

The control unit **3** includes a user interface **650**. The user interface **650** is provided on the exterior of the housing **602**. The user interface **650** can receive user input and provide information regarding the status of the system **201**. For example, a power user input **670** receives user input to turn on or off the control unit **3**. Upon receipt of user input the power user input **670** is part of the motor control circuitry **225** and the power user input **670** signals the control unit **3** to turn the control unit **3** on or off. When the control unit **3** is "on" the control unit **3** is ready to provide power to the vacuum unit **205** in accordance with control signals received by the control unit **3**.

As a further example, the user interface **650** can include a pairing user input **675** to activate a pairing sequence between the communication module **576** and a corresponding communication module, such as a communication module at the handle **213** as described earlier herein. Known methods for pairing wireless devices can be used and will not be described further herein. A pairing indicator **680**, such as an LED, can indicate commencement of a pairing sequence, for example by flashing, and successful pairing, for example by illuminating continuously.

As yet another example, the user interface **650** can include a motor parameter setting sequence user input **682** to initiate detection and storage of motor running parameters by the control circuitry **225**. The sequence can be referred to as a "learn mode". A learn mode indicator **690** can be provided to indicate the status of the learn mode sequence. An example of parameters to be detected and stored during learn mode is described in U.S. Pat. No. 7,403,360 of J. Vern Cunningham issued Jul. 22, 2008.

Referring to FIG. **4**, the heat sink **240** is mounted to the housing **602** and to the conduit **512**.

Referring to FIG. **5**, each cover **652** has mounting brackets **700** to receive and retain the heat sink **240** in place. The heat sink **240** is retained by the mounting brackets **700** from movement perpendicular to the plane of the heat sink **240** and by the cover walls from movement parallel to the plane of the heat sink **240**.

Each cover **652** has opposing overlaps **702**, **704** about an edge **706**. The overlaps **702**, **704** are indented asymmetrically on each cover **652** such that the covers **652** can be identical. This can reduce manufacturing costs.

Hole bosses **710** are spaced about each cover **652** to allow for bolts, not shown, to be used to attach the covers **652**. Alternative methods can be used to attach the covers **652**, such as for example screws, glue, interlocking tabs or a press fit. It is recognized that alternative cover designs are possible. It is also recognized that the control unit **3** can be formed without a housing **650** having a unitary construction.

Referring to FIG. **6**, a combined ported conduit heat sink **800** could be formed from thermally conductive material. The combined conduit heat sink **800** has a conduit **802** and a component mount **804**. Opposing open ends of the conduit **802** provide ports **806**, **808**. The conduit and mount **804** together form the heat sink **800**. The mounting portion **804** provides a flat planar surface **810** to which the component **572** may be mounted. When the heat sink **800** is connected in the cleaning air path **270** at the ports **806**, **808** the heat sink **800** is in thermal contact with the cleaning air path **270**.

Referring to FIG. **7**, a control unit **850** utilizes the heat sink **800**. Component **572** is mounted to the mount **804**. Additionally, board **233** is mounted to the mount **804**. A housing **860** is mounted to the mount and encloses the circuitry **225**, and receptacle plate **656**.

The mount **804** can be of a smaller size sufficient to provide thermal conduction from the component **572**. The housing **860** can attach to the mount **804** or can attach to other elements of the control unit **3** or the system **201**. For example, the housing **860** can attach to the conduit **802**.

Other embodiments and aspects will be evident from the detailed description and drawings hereof. For example, such aspects may include alternative combinations of the elements of the aspects set out above, and combinations that include fewer or more elements in combination with other elements from the detailed description, or combinations that are drawn from the detailed description alone.

It will be understood by those skilled in the art that this description is made with reference to the preferred embodiments thereof and that it is possible to make other embodiments employing the principles of the invention which fall within its spirit and scope as defined by the following claims.

We claim:

1. A central vacuum cleaning system comprising:
- a vacuum unit,
- a plurality of inlet valves,
- an exhaust,
- a cleaning air path from the inlet valves through the vacuum unit to the exhaust,
- a control unit comprising:
  - a power input,
  - a power output,
  - motor control circuitry to control application of power from the
  - power input to the power output,
  - a first port,
  - a second port,

a conduit providing a conduit air path between the first port and the second,

a heat sink in thermal contact with the conduit air path and a component of the motor control circuitry,

wherein the control unit is connected through the first port and the second port in the cleaning air flow path between one of the plurality of inlet valves and the exhaust, and the power output is connected to a power input of the vacuum unit.

2. The system of claim **1** wherein the control unit is connected in the cleaning air path between the vacuum unit and the inlet valves in air flow communication with all inlet valves.

3. The system of claim **1** wherein the control unit is connected in the cleaning air path between the vacuum unit and the exhaust.

4. The system of claim **1** further comprising central vacuum cleaning system piping between the inlet valves and the vacuum unit, and between the vacuum unit and the exhaust, wherein the piping provides a portion of the cleaning air path, and the first port and second port are piping ports connected to the piping.

5. The system of claim **1** wherein the heat sink forms a surface of the conduit in the conduit air path.

6. The system of claim **1** further comprising a motor control housing that houses the motor control circuitry, and wherein the heat sink forms a surface of the motor control housing.

7. The system of claim **1** further comprising a motor control housing that houses the motor control circuitry, and wherein the heat sink is mounted to the housing and to the conduit.

8. The system of claim **7** further comprising a small aperture connecting the housing and the conduit air path.

9. A central vacuum cleaning system control unit for installation in a central vacuum cleaning system having a vacuum unit, a plurality of inlet valves, an exhaust, and a cleaning air path from the inlet valves through the vacuum unit to the exhaust, the control unit comprising:

a power input,

a power output,

motor control circuitry to control application of power from the power input to the power output,

a first port,

a second port,

conduit providing at least part of the cleaning air path between the first port and the second, and

a heat sink in thermal contact with the cleaning air path and a component of the motor control circuitry.

10. The control unit of claim **9**, wherein the first port and the second port are piping ports to connect to central vacuum cleaning system piping in the system.

11. The control unit of claim **9** wherein the heat sink forms a surface of the conduit in the conduit air path.

12. The control unit of claim **9** further comprising a motor control housing that houses the motor control circuitry, and wherein the heat sink forms a surface of the motor control housing.

13. The control unit of claim **12** further comprising a small aperture connecting the housing and the conduit air path.

14. The control unit of claim **9** further comprising a motor control housing that houses the motor control circuitry, and wherein the heat sink is mounted to the housing and to the conduit.

15. A method of cooling motor control circuitry in a central vacuum cleaning system, the method comprising:

generating a vacuum to create air flow in a cleaning air path from one of a plurality of inlet valves through a vacuum unit to an exhaust, wherein the cleaning air path includes a conduit air path of a control unit connected between one of the plurality of inlet valves and the exhaust and the control unit comprising a power input, a power output, motor control circuitry to control application of power from the power input to the power output, a first port, a second port, a conduit providing the conduit air path between the first port and the second port, and a heat sink in thermal contact with the conduit air path and a component of the motor control circuitry.

16. The method of claim **15** wherein the conduit air path of the control unit is connected in the cleaning air path between the vacuum unit and the inlet valves in air flow communication with all inlet valves.

17. The method of claim **15** wherein the conduit air path of the control unit is connected in the cleaning air path between the vacuum unit and the exhaust.

18. The method of claim **15** wherein the central vacuum cleaning system includes piping between the inlet valves and the vacuum unit, and between the vacuum unit and the exhaust, and the piping provides a portion of the cleaning air path, and the first port and second port are piping ports connected to the piping.

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