May 14, 1968 C. L. SANDSTROM 3,382,524

CONTROL FOR A VACUUM CLEANER SYSTEM

Filed July 21, 1966

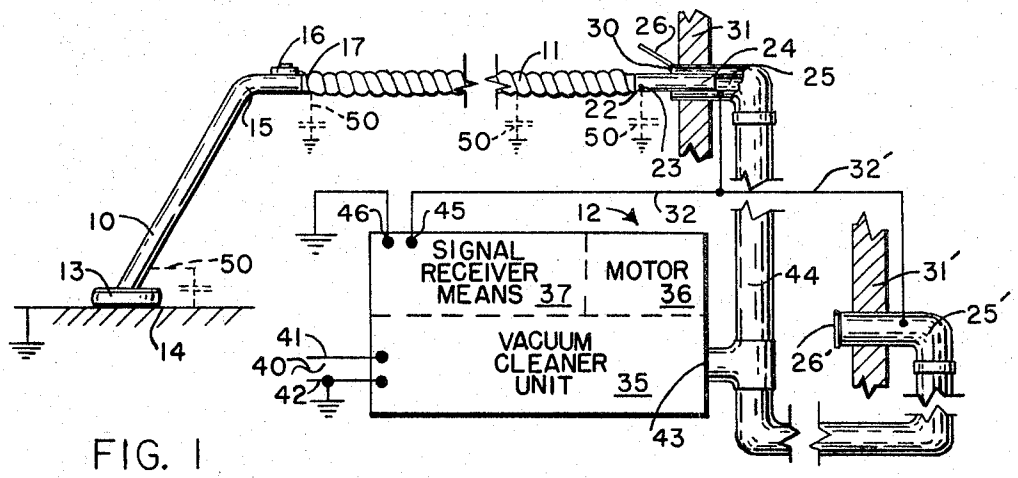


FIG. 1

FIG. 2

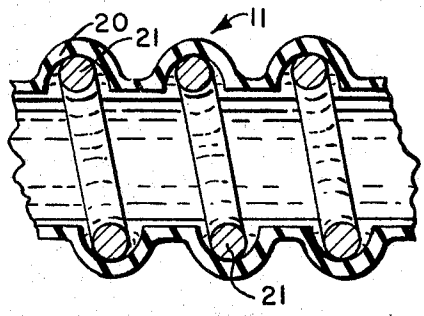


FIG. 3

FIG. 4

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United States Patent Office 3,382,524 Patented May 14, 1968

3,382,524

CONTROL FOR A VACUUM CLEANER SYSTEM

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Filed July 21, 1966, Ser. No. 566,962
8 Claims. (15—314)

The present invention is an improved type of vacuum cleaner system, and is more particularly a vacuum cleaner system that utilizes a remote control arrangement for starting and stopping the vacuum cleaner motor.

In recent years central vacuum cleaner systems have become commercially important even though they have broadly been known and occasionally used for quite some time. In more recent years central vacuum cleaner systems have been developed for installation in residential construction wherein a single vacuum cleaner unit is provided which has the motor and suction equipment. The vacuum cleaner unit is normally mounted in the basement of a home and has fixed pipes connected through the walls of the home to various locations for the convenience of the home owner. The fixed locations have openings into which a vacuum cleaner hose of a flexible type can be connected, and the vacuum cleaner hose in turn is connected to a vacuum cleaner wand that is used directly for cleaning purposes.

In central vacuum cleaner systems it has been common to start the vacuum cleaner unit by energizing the vacuum cleaner motor and then allowing the vacuum cleaner unit to run continuously while moving the vacuum cleaner hose and wand around from location to location within the structure. It has been impractical to start and stop the motor in the vacuum cleaner unit from the remote vacuum cleaner wand location due to the complexities and problems of electrical control. One possible solution to this arrangement has been the incorporation of a pair of conductors along the vacuum cleaner hose so that a conventional electrical control system can be plugged into the vacuum cleaner unit along with the hose. This arrangement entails the addition of two electrical conductors to the hose and equipment normally required and thereby adds both inconvenience and a substantial amount of cost to the overall central vacuum cleaner system.

The present invention recognizes the desirability of remote control of a vacuum cleaner system and particularly of a central vacuum cleaner system. The present invention specifically accomplishes the control of the vacuum cleaner system by a means that adds little cost to the equipment normally installed for the vacuum cleaner system itself. In the present invention the control of the vacuum cleaner unit is accomplished by connecting an electric circuit to the vacuum cleaner motor by means of the metallic support conductor, normally a spring-like coil, that supports the vacuum cleaner hose. Almost all vacuum cleaner hoses are made up of a flexible, air-tight material and include a continuous resilient electrical conductive support in the form of a wire spiral made of a spring metal. The present invention utilizes this single conductor as part of an electrical circuit between the vacuum cleaner wand and the vacuum cleaner unit so that a control of the vacuum cleaner unit can be accomplished without the addition of any further conductors. The return path which is necessary for the electrical control system is the inherent distributed electrical capacitance to ground between the hose structure and the normal ground circuit. The application of a potential between the vacuum cleaner hose support wire and ground would be impractical except in the case of a short duration pulse that can pass through this electrical circuit due to the

distributed capacitance. In the present invention, a pulse generating source is mounted at the vacuum cleaner wand and is connected to the support wire to provide a pulse of electrical energy to the vacuum cleaner unit. The vacuum cleaner unit incorporates a signal receiving means that responds to the electrical pulse and thereby alternately turns the vacuum cleaner system "on" or "off." This arrangement also could be used to step the vacuum cleaner through various phases of operation in case different vacuum cleaner speeds were available in the unit, or to change air flow from suction to blower if the vacuum systems were so equified.

Very briefly, the present invention specifically is directed to a vacuum cleaner system made up of a wand, a connecting hose, and a vacuum cleaner unit all mechanically connected together as a vacuum cleaner system wherein the system is electrically controlled by a pulse source mounted at the vacuum cleaner wand and which transmits its energy for control to the vacuum cleaner unit over the support wire in the flexible vacuum cleaner hose and the distributed capacitance to ground.

The present invention will be described in detail in the present specification in connection with the appended drawings, wherein:

FIGURE 1 is a schematic representation of the vacuum cleaner system in its entirety;

FIGURE 2 is a cross section of a piece of a typical hose used in the system;

FIGURE 3 is an electrical schematic disclosure of the control circuit wherein the pulse generator for the system is a charged capacitor; and

FIGURE 4 is a representation of a second type of pulse generating device.

In FIGURE 1 a central vacuum cleaner system is shown and includes a wand means **10**, hose means **11**, and a vacuum cleaner unit means **12**, all of which are mechanically connected together to form a central vacuum cleaner system.

The wand means **10** has a conventional head **13** adjacent a surface, such as a floor **14**, and a pipe **15** which forms a handle for operation of the vacuum cleaner wand means **10** over any convenient surface. Mounted on the pipe or handle **15** is an electric signal generating means **16** that will be described in some detail in connection with FIGURES 3 and 4. The electric signal generating means **16** is capable of supplying a pulse of voltage to a conductor **17** that connects into the hose means **11**.

The hose means **11** is fabricated in a conventional manner as is disclosed in FIGURE 2. The hose means **11** is formed of a flexible air-tight material **20** such as a plastic that in fact forms the hose. The air-tight material **20** encloses a spiral wire **21** that continues through the hose means **11** as a resilient electrically conductive support means. The wire or coil **21** could also be individually encased in a plastic or insulating material if desired but in the simplest form the hose means **11** is made up of the flexible housing material **20** supported by the internal wire **21**.

Again referring to FIGURE 1, the hose means **11** has the wire **21** connected to wire **17** so that the electric signal generating means **16** is connected to the conductor that exists within the normally constructed hose means **11**. The hose means **11** has an outlet conductor **22** at an end opposite the end where the electric signal generating means **16** is connected. The conductor **22** connects at **23** to a cylindrical metal sleeve **24** that forms an outlet for the hose means **11**. The outlet **24** slides into a connector **26** which can be considered an inlet for the vacuum cleaner unit. Attached to the inlet **25** is a cover **26** that drops down over the end **30** of the inlet **25** when the hose means **11** is not in place. The inlet **25** is located in a wall

31 of a building structure in which the central vacuum cleaner system is installed. Also, connected to the vacuum cleaner unit inlet is an electrical conductor 32 that continues the circuit from the electric signal generating means 16 to the vacuum cleaner unit means 12.

The vacuum cleaner unit means 12 is made up specifically of a vacuum cleaner unit 35 that is generally conventional in structure and includes a motor 36 that is energized through a signal receiver means 37 from a source of electrical energy 40. The source of electrical energy 40 applies a voltage between a conductor 41 and a second conductor 42. The conductor 42 is grounded, as is normal in most electrical distribution systems. The vacuum cleaner unit 35 has an inlet 43 to which is connected a pipe 44 that in turn connects mechanically the vacuum source to the inlet 25 for the system.

A second inlet to the system is shown at 25' and has a cover 26' shown in a closed position, since the inlet 25' is not in use. The inlet 25' is supported by a wall 31' that is located at any convenient place in the structure in which the central vacuum cleaner system is used. The conductor 32 is extended at 32' to electrically connect the inlet 25' to the electric signal receiving means 37 at terminal 45, and wherein the system is further grounded at terminal 46.

It is noted that the wand means 10 has a capacitance 50 disclosed between the wand means 10 and the floor 14 as well as similar capacitances 50 between the hose means 11 and ground. The capacitance 50 between the wand means 10 and the hose beans 11 and ground is the normal distributed capacitance between any conductive body and ground. The capacitance is of an exceedingly small value, but is important in the present control system.

The broad operation of the present unit will now be described. The vacuum cleaner unit is energized from source 40 and the signal receiver means 37 is thereby energized. The signal receiver means can be any type of electrical amplifying device capable of sensing a pulse of voltage between the terminals 45 and 46 for energization of a stepping-type relay that in turn connects power to the motor 36 so that the blower in the vacuum cleaner unit 35 can be turned "on" and "off."

When the hose means 11 is connected to inlet 25, a complete electric circuit is in existence from the electric signal generating means 16 through wire 17 and the support wire 21 of the hose means 11 to the conductor 32 that is in turn connected to the inlet terminal 45 of the vacuum cleaner unit 35. The signal receiving means 37 of the vacuum cleaner unit 35 is grounded at 46.

In use, the electric signal generating means 16 is operated to create a pulse of voltage that is applied to conductor 17 and the support wire 21 of the hose means 11. This pulse of voltage is in turn supplied between terminals 45 and 46 of the signal receiver means 37 thereby applying a pulse of voltage to energize the signal receiver means 37. This receiver means, such as an amplifier and relay, in turn switches "on" the motor 36 of the vacuum cleaner unit 35. After the use of the vacuum cleaner system is complete, the electrical signal generating means 16 is again activated to create a pulse. This second pulse turns the motor 36 "off" thereby deactivating the system. With this arrangement a central vacuum cleaning system has been provided that is capable of remote control with the addition of no extra wires between the vacuum cleaner wand means 10 and the wall 31. Existing systems now in use generally require that the person using the system return to the wall 31 to activate a switch that in turn controls the vacuum cleaner system.

In FIGURE 3 a circuit is disclosed which incorporates the signal generating means 16 in one embodiment. The signal generating means 16 includes a source of direct current voltage or battery 51 connected by a switch 52 to a capacitor 53. When the switch 52 is closed the capacitor 53 is charged to a voltage equal to the voltage of the direct current source means 51. When the system is to be used the electric signal generating means is operated by opening the switch 52 and closing a second switch 54. The second switch 54 connects the capacitor 53 to the conductor 21 that is the central support of the hose means 11. Conductor 21 is connected to terminal 45 of the signal receiving means 37, which has been disclosed as including an impedance 55 between the terminal 45 and 46 of the signal receiving means 37. A relay 56 is disclosed operating contact means 57 to supply electrical energy from conductors 41 and 42 to the motor 36. The return path for the pulse generating means 16 has been disclosed as between ground and the capacitors 50 that form the inherent capacity between the hose means 11 and ground. It is seen that while a direct current circuit is not available for a high frequency or pulse of energy so that the relay 56 can be energized by the operation of the pulse generating means 16.

In FIGURE 4 an alternate pulse or signal generating means 16 has been disclosed. The pulse generating means 16 is in the form of a frame 60 that has a lever 61 pivoted at 62 on the frame 60. The lever 61 has a projection 63 that is adjacent a weight 64 that is spring loaded at 65 and 66 so as to be supported between the legs 67 and 68 of the frame 60. The weight 64 can be caused to move down against an insulator 70 and a piezoelectric crystal 71 that is mounted between the insulator 70 and the leg 68 of the frame 60. Connected to the piezoelectric crystal 71 is the wire 17 which provides an output conductor for the pulse generating means 16 disclosed in FIGURE 4. A portion of the handle 15 of the vacuum cleaner wand means 10 is disclosed.

In operation, the device in FIGURE 4 generates a pulse on conductor 17 whenever the handle 61 is depressed. Depressing the lever 61 causes the weight 64 to be raised compressing spring 65 and extending spring 66. As the lever 61 is further depressed a sudden release of weight 64 is accomplished allowing the weight 64 to impact against the insulator 70 and the crystal 71. It is well known that an impact force or squeezing force on a piezoelectric crystal generates a very high voltage pulse of very short duration. This pulse is applied between the conductor 17 and the distributed capacitance 50 between the frame or handle 15 of the vacuum cleaner wand 10 to the overall system thereby operating the system.

The vacuum cleaner control system described above can be applied to any type of vacuum cleaner unit where the wand means is connected to the vacuum cleaner unit by a hose incorporating some type of electrically conducting support. This type of system has particular utility in the central vacuum cleaner systems where the vacuum cleaner unit is located remotely from the vacuum cleaner wand and where it is desirable to have at least an "off-on" control of the vacuum cleaner motor. The present system can be utilized to step a relay through a progression of switching functions to thereby control a vacuum cleaner unit that may have more than one speed.

It is obvious that the invention contained in the present application can be modified in many ways within the inventive concept and the applicant wishes to be limited in the scope of his invention solely by the scope of the appended claims.

I claim as my invention:

1. A vacuum cleaner system, including: wand means, hose means, and vacuum cleaner unit means mechanically connected together to form a vacuum cleaner system; said hose means formed of a flexible air-tight material and including continuous resilient electrically conductive support means; said wand means including an electric signal generating means connected to said electrically conductive support means; and said vacuum cleaner unit means including an electrical signal receiver means electrically connected to said hose conductive support means; said signal generating means controlling said vacuum cleaner unit means by transmitting an electric signal over

said continuous resilient conductive support means to said electrical signal receiver means.

2. A vacuum cleaner system as described in claim 1, wherein said electrically conductive support means is a metallic coil spring within said hose means and electrically insulated by said hose means.

3. A vacuum cleaner system as described in claim 1, wherein said electrically conductive support means has an inherent distributed electrical capacitance to ground; and said electrical signal generating means is an electrical pulse generating means that supplies a control voltage pulse between said support means and said ground to said electrical signal receiving means to control said vacuum cleaner system.

4. A vacuum cleaner system as described in claim 3, wherein said electrically conductive support means is a metallic coil spring within said hose means and electrically insulated by said hose means.

5. A vacuum cleaner system as described in claim 4, wherein said electrical pulse generating means includes a capacitor initially charged from a direct current source and subsequently connected between said coil spring and said ground to generate said control voltage pulse for said vacuum cleaner unit.

6. A vacuum cleaner system as described in claim 5, wherein said control voltage pulses received at said electrical signal receiving means alternately start and stop said vacuum cleaner unit to remotely control the operation of said vacuum cleaner system.

7. A vacuum cleaner system as described in claim 3, wherein said electrical pulse generating means includes a capacitor initially charged from a direct current source and subsequently connected between said conductive support means and said ground to generate said control voltage pulse for said vacuum cleaner unit.

8. A vacuum cleaner system as described in claim 3, wherein said vacuum cleaner unit means is permanently mounted within a building structure; said vacuum cleaner unit having a plurality of normally closed inlets at different locations within said building structure; and said hose means being selectively connected to one of said inlets to complete both vacuum connection and electrical connections to form said vacuum cleaner system.

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