Sept. 2, 1969 J. C. HAMRICK 3,464,859

METHOD AND APPARATUS FOR VACUUM CLEANING

Filed Aug. 19, 1966 5 Sheets-Sheet 1

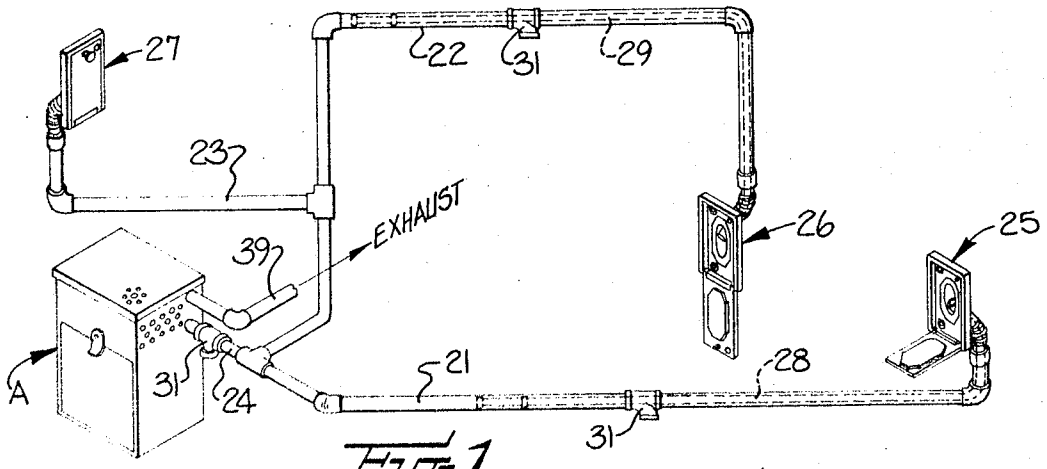


Fig-1

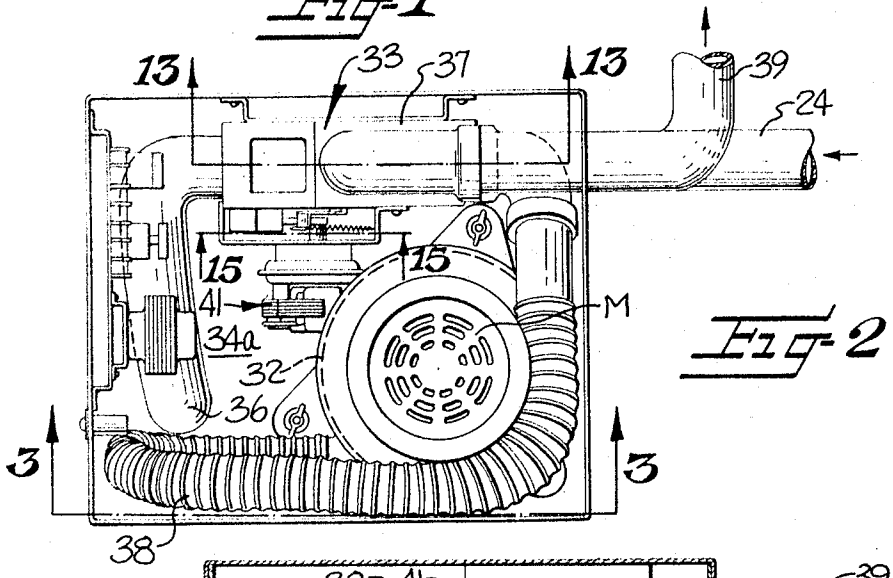


Fig-2

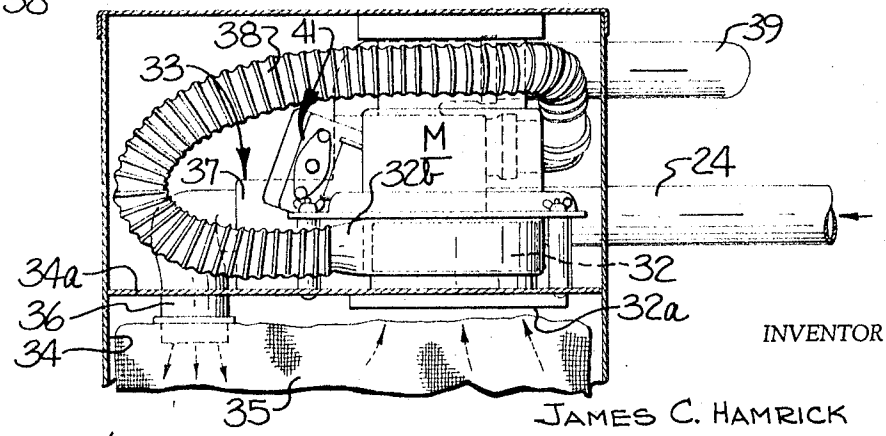


Fig-3

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Sept. 2, 1969 J. C. HAMRICK 3,464,859

METHOD AND APPARATUS FOR VACUUM CLEANING

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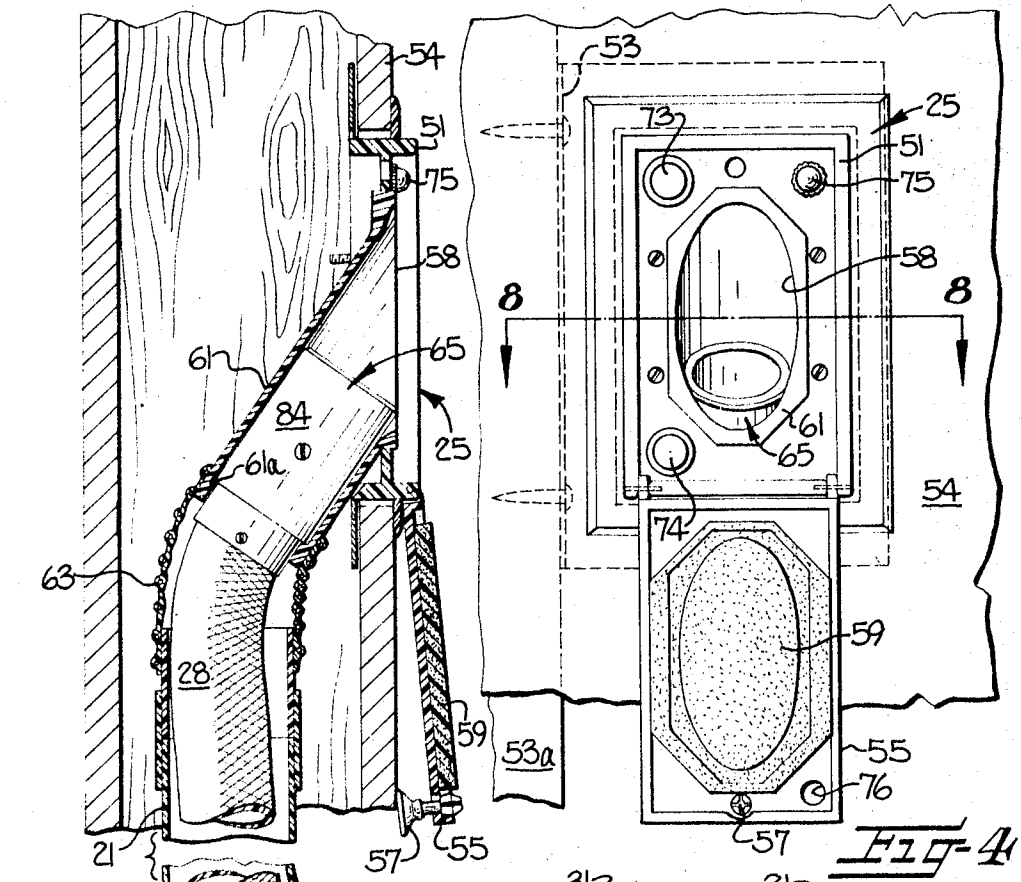


Fig-4

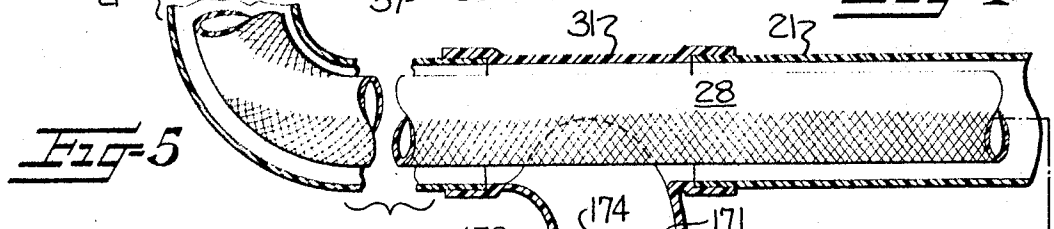


Fig-5

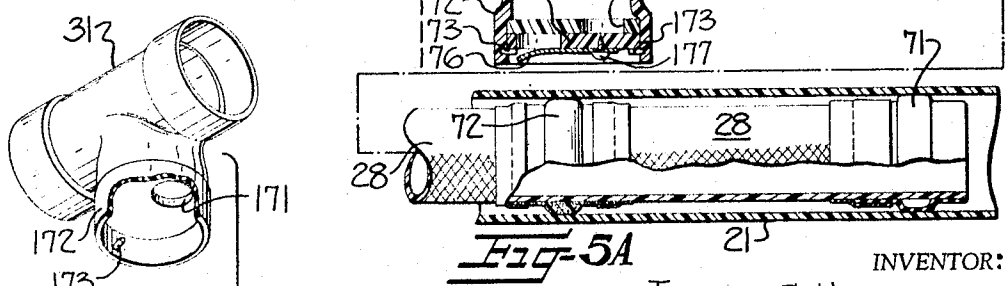


Fig-5A

Fig-6

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Sept. 2, 1969 J. C. HAMRICK 3,464,859

METHOD AND APPARATUS FOR VACUUM CLEANING

Filed Aug. 19, 1966 5 Sheets-Sheet 3

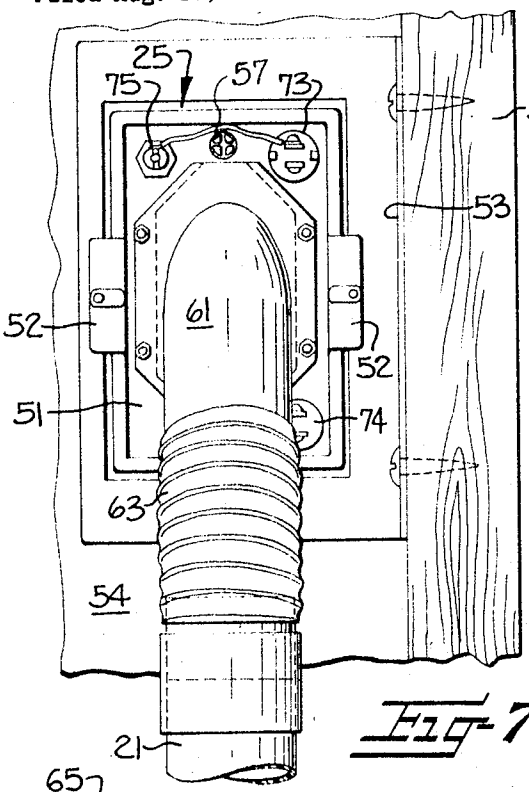


Fig-7

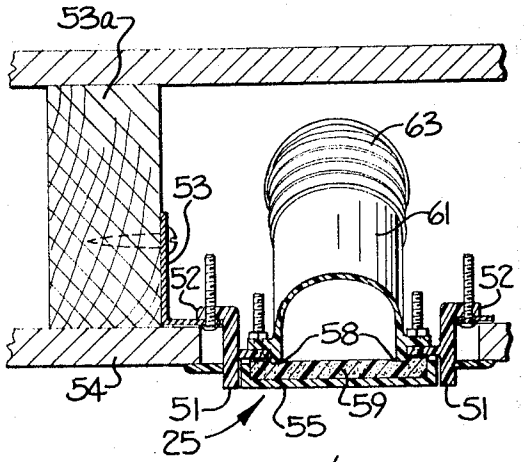


Fig-8

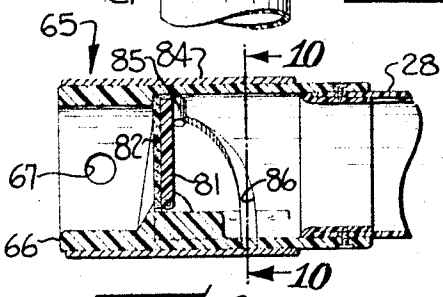


Fig-9

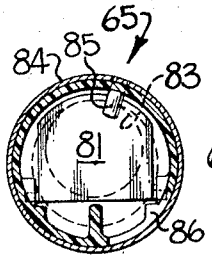


Fig-10

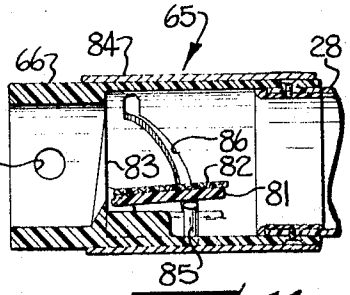


Fig-11

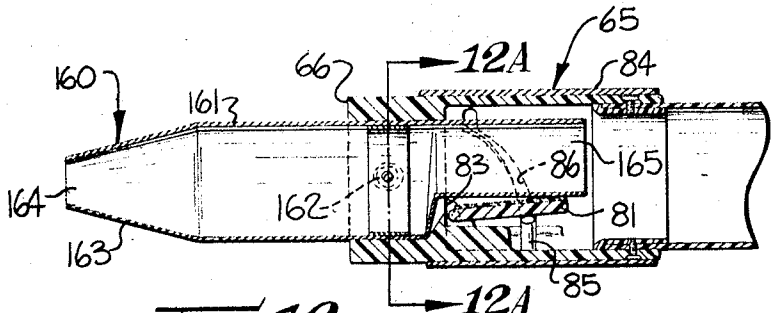


Fig-12

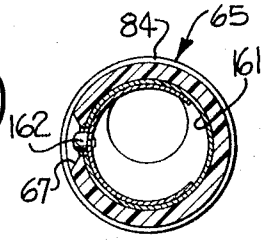


Fig-12A

Sept. 2, 1969 J. C. HAMRICK 3,464,859

METHOD AND APPARATUS FOR VACUUM CLEANING

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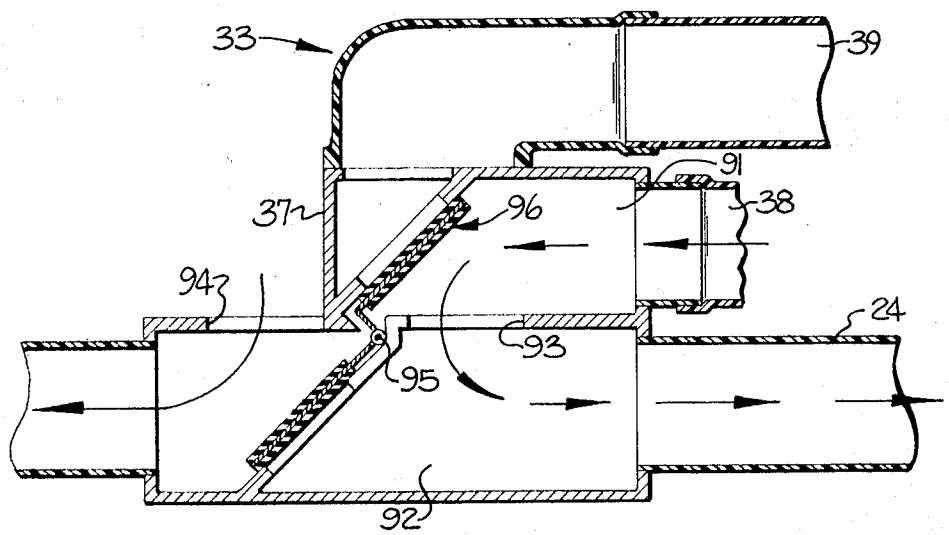


Fig-13

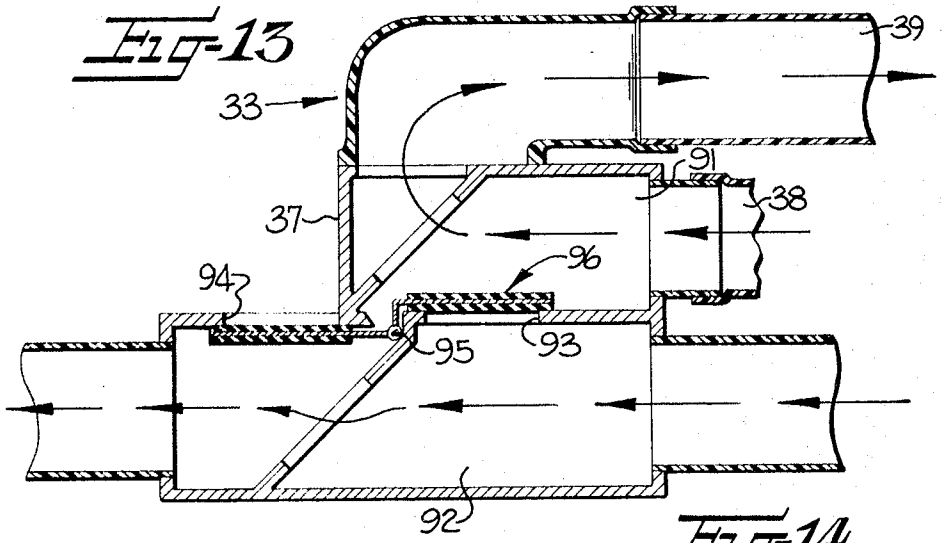


Fig-14

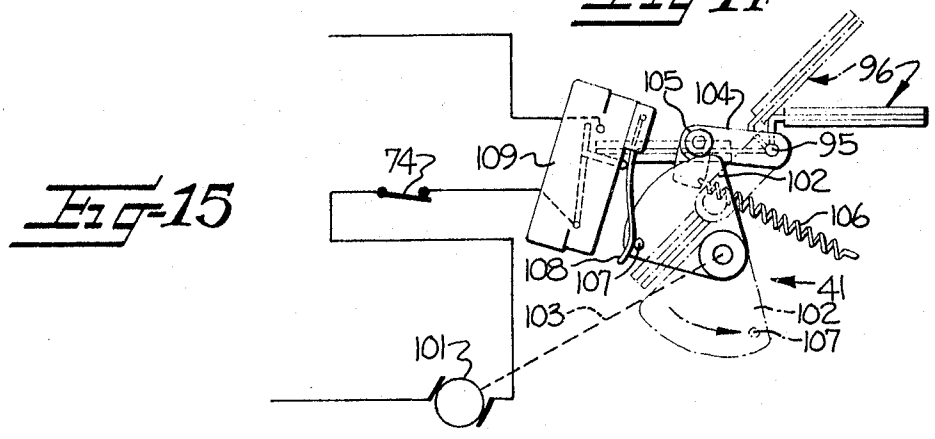


Fig-15

METHOD AND APPARATUS FOR VACUUM CLEANING

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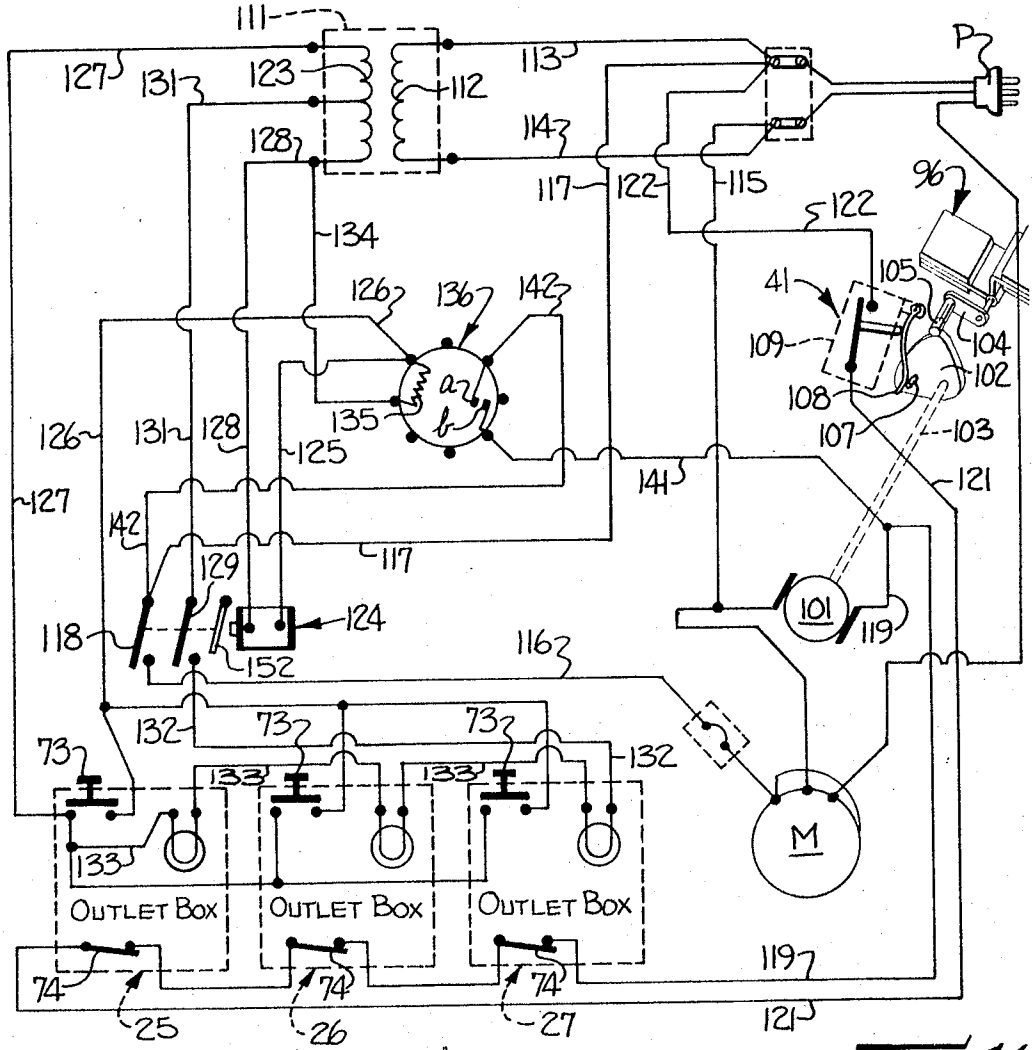


FIG-16

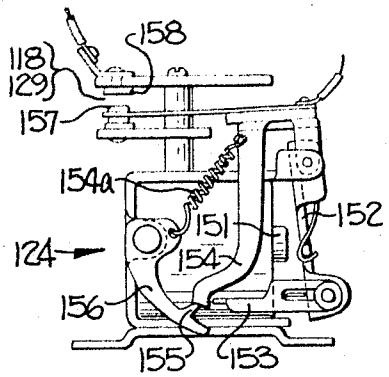


FIG-17

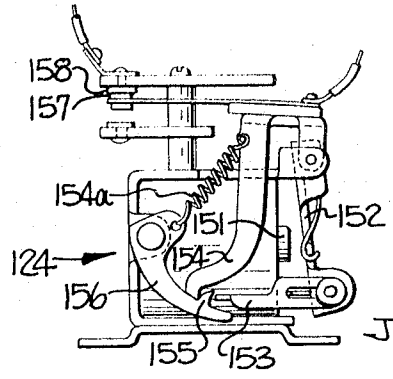


FIG-18

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United States Patent Office 3,464,859 Patented Sept. 2, 1969

3,464,859

METHOD AND APPARATUS FOR VACUUM CLEANING

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Continuation-in-part of application Ser. No. 458,178, May 24, 1965. This application Aug. 19, 1966, Ser. No. 573,707

Int. Cl. B08b 5/04

U.S. Cl. 134—21 18 Claims

ABSTRACT OF THE DISCLOSURE

A vacuum cleaning system having a cleaning hose which is retractably stored within a conduit communicating with a suction blower and wherein the suction blower is utilized to extend the hose outwardly of the conduit by creating a pressure in the conduit above atmospheric pressure. Also, the suction blower serves for withdrawing the cleaning hose into the conduit into retractably stored position.

This application is a continuation-in-part of my co-pending application for 'Suction Cleaning System and Method," Ser. No. 458,178, filed May 24, 1965, now Patent No. 3,353,996 and relates to a new and improved method and apparatus for storing, extending and retracting suction cleaning tubes or hoses with respect to conduits of a centralized suction or vacuum cleaning system.

The suction cleaning system of said co-pending application includes method and apparatus in which a suction hose of desired length, usually about thirty feet long, is normally stored in a stationary pneumatic conduit and which may be partially or substantially fully withdrawn from the conduit, and wherein the hose may be so controlled as to partially or fully retract the same within the conduit by controlling at the hose the effectiveness of existing suction force in the conduit acting on the hose.

According to embodiments disclosed in said co-pending application, a desired length of the hose is manually withdrawn from the stationary conduit. Such manual withdrawal of the suction hose is not objectionable in various centralized suction cleaning systems, especially if a suction force is not induced in the conduit until after the desired length of the suction hose has been withdrawn. It can be appreciated, however, that the operation of the suction cleaning system can be improved if the extending of the suction hose is effected or aided by other than manually exerting an outward pulling force thereon.

Acordingly, it is the primary object of this invention to provide an improved method and apparatus for cleaning, utilizing a conduit and a flexible cleaning hose movable longitudinally within the conduit and wherein outward movement or extension of the hose from the outlet end of the conduit is effected by creating a positive pneumatic pressure substantially above atmospheric pressure in the conduit for blowing at least a portion of the hose out of the conduit, terminating the pneumatic pressure, and then conducting a suction current through the medium of the hose to an area to be cleaned.

Another object is to provide a method and apparatus of the type described in which the pneumatic pressure is created by directing a blowing air stream into the conduit and restricting its flow through the hose to extend at least a portion thereof, and wherein the suction current is produced by reversing the direction of flow of the air stream.

Still another object is to provide a method and apparatus of the type described wherein partial or substantially complete retraction of the suction hose into the conduit is effected by sufficiently restricting flow of the suction current into the hose and the conduit so that the hose is sucked into the conduit under impetus of a reduced pneumatic pressure in the conduit below atmospheric pressure.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which

FIGURE 1 is a schematic perspective view of a centralized pneumatic cleaning system embodying the present invention as it may be installed in a building;

FIGURE 2 is a plan view of the central pneumatic unit of FIGURE 1 with the top wall or cover removed and showing a preferred arrangement of the air circulating means and associated components;

FIGURE 3 is a fragmentary vertical sectional view taken substantially along line **3—3** of FIGURE 2;

FIGURE 4 is a front view of one of the outlet boxes looking at the right-hand side of FIGURE 5;

FIGURES 5 and 5A are, collectively, a vertical sectional view of an outlet box for one of the conduits of the system, shown mounted in a wall of the building, and including a flexible pneumatic cleaning or suction hose therein;

FIGURE 6 is a partially exploded perspective view of a preferred form of bleeder valve used in the conduits of the cleaning system;

FIGURE 7 is a rear view of the outlet box of FIGURE 4;

FIGURE 8 is a sectional plan view of the outlet box taken along line **8—8** of FIGURE 4;

FIGURE 9 is a longitudinal sectional view through the hand valve unit, showing the same in closed position connected to the outer end of one of the flexible suction hoses;

FIGURE 10 is a transverse sectional view taken along line **10—10** of FIGURE 9;

FIGURE 11 is a sectional view similar to FIGURE 9, but showing the valve in open position;

FIGURE 12 is a view similar to FIGURE 11 showing a blowing adapter member positioned in the hand valve and arranged to hold the clapper or check valve member in open position during use of the same for blowing cleaning;

FIGURE 12A is a transverse sectional view taken along line **12A—12A** of FIGURE 12;

FIGURE 13 is a vertical sectional view of the central control valve of the system taken along line **13—13** of FIGURE 2, showing the valve clapper elements in "blow-out" position;

FIGURE 14 is a view similar to FIGURE 13, showing the valve clapper elements in an alternate or "suction" position;

FIGURE 15 is a schematic view of the control means associated with the central control valve of FIGURES 13 and 14, including a portion of the electrical circuit associated therewith;

FIGURE 16 is a schematic diagram of the electrical control circuit of the pneumatic cleaning system, and

FIGURES 17 and 18 are side elevations of an electromagnetic latching relay of the electrical system and showing the contacts thereof in two different positions.

Referring more specifically to the drawings, FIGURE 1 shows a typical pneumatic cleaning installation of the present invention wherein a plurality of stationary collection conduits **21**, **22**, **23** communicate by a common collection conduit **24** with a central pneumatically-operated dirt collection chamber housed in an enclosure A. Collection conduits **21**, **22**, **23** may extend generally be-

neath the floor or in the ceiling of a building, as desired, and have respective outlet boxes or stations **25**, **26** and **27** suitably positioned in the floor or wall of the building to provide openings therein for the reception and storage of flexible pneumatic cleaning or vacuum hoses, two of which are shown at **28**, **29**. For purposes of illustration, it may be assumed that the horizontal runs of conduits **21**, **22** extend beneath the floor and above the ceiling, respectively, with the outlet boxes **25**, **26**, **27** mounted in openings in the vertical walls of a building. A plurality of bleeder or check valves **31** may be positioned intermediate the lengths of conduits **21**, **22**, **24** for purposes to be later described.

Although a separate flexible vacuum hose may be used in outlet box **27** and its conduit **23**, this outlet box is shown without a vacuum hose by way of illustrating that either hose **28** or **29** may be alternatively connected to outlet box **27**, if desired. It may be desired to use a lesser number of hoses than there are outlet boxes for purposes of economy, or construction conditions may dictate that conduit **23**, for example, may be too short to completely receive a vacuum hose of the desired length therein.

In operation of the system according to my said copending application, a portion of either suction hose **28**, **29** is withdrawn manually from the corresponding outlet box, a suitable cleaning implement is attached thereto, and the system is energized to produce suction currents in the hose and conduits to collect dirt and waste materials. When an area adjacent the outlet has been cleaned, the hose is retracted back into the corresponding outlet box and conduit by suction for storage until subsequent use thereof.

By incorporating into the system the novel features of the present invention, the flexible vacuum hoses can be easily extended, as well as retracted, by pneumatic pressure created by the air impeller means of the system. By providing a control valve to selectively direct the flow of air inwardly or outwardly along the collection conduits of the system, while simultaneously restricting the flow of air through the hose, negative and positive pressures can be created alternatively in the collection conduits, which pressures act upon the hose to propel it in and out of the conduit.

As seen in the drawings, an upper section of enclosure A (FIGURE 2) houses an air impeller or fan **32** driven by an electric motor M and connected to a central control valve generally indicated at **33**. Valve **33** constitutes means for selectively directing pneumatic currents produced by impeller **32** throughout the various conduits of the system, as will be explained. Located below motor M and control valve **33** is a dust or dirt collection chamber **34** (FIGURE 3) partially defined by a horizontal partition **34***a* upon which motor M, fan **32** and valve **33** may be mounted. Chamber **34** contains a pervious filter bag **35** for the removal of dirt from air currents passing through the system. Filter bag **35** is connected to and communicates directly with an inlet conduit **36** which may penetrate partition **34***a* and is connected to a housing **37** of control valve **33**. The inlet or suction side **32***a* of fan **32** communicates with chamber **34** through partition **34***a* to establish an air flow therethrough from the conduits **21**–**24** of the system.

The outlet or discharge side **32***b* (FIGURES 2 and 3) of fan **32** is connected, as by a flexible conduit **38**, to valve housing **37**. Valve housing **37** also has common conduit **24** and an exhaust conduit **39** connected thereto. The outer end of conduit **39** is open to the atmosphere. An electrical control device, generally indicated at **41** (FIGURES 2, 15 and 16), is operatively associated with control valve **33** to interconnect the various conduits of the system in a manner to be later described.

Each outlet box **25**, **26**, **27** may be of substantially the same construction and only outlet box **25** will be described in detail. However, since conduit **22** extends downwardly from its horizontal run, it will be noted that outlet box **26** is inverted as compared to outlet boxes **25**, **27**. As best shown in FIGURES 4, 5, 7 and 8, outlet box **25** may include an outer frame **51** (FIGURE 5) which is preferably generally rectangular in shape and has side flanges **52** (FIGURES 7 and 8) which cooperate with an angle bracket **53** (FIGURE 8) to secure box **25** to a stud **53***a* or other suitable building frame member adjacent an opening in an outer panel **54** of a building wall. A door **55** may be hingedly connected to frame **51** and has manually releasable locking means, shown as a snap fastener **57** (FIGURES 4, 5 and 7), to secure the door in closed position. Also secured to frame **51** is a short tubular outlet adapter or receptacle **61**, defining an outlet opening **58**, and which may extend downwardly and rearwardly at an angle and may be connected to collection conduit **21** by a flexible sleeve **63**. A gasket **59**, preferably in the form of a sponge rubber plate or the like, is mounted on door **55** so as to engage the receptacle **61** and seal opening **58** against the passage of air therethrough when door **55** is closed and outlet box **25** is not in use.

As shown in FIGURES 4 and 5, receptacle **61** has the corresponding operating end of flexible suction or cleaning hose **28** adjacent the same, and a hand valve unit **65** is attached to the outer end of hose **28** and fits within receptacle **61**. A sleeve **84** on hand valve unit **65** may rest against a restricted or shoulder portion **61***a* of receptacle **61** while the cleaning hose **28** occupies stored position in collection conduit **21**. The tubular outer end portion **66** of hand valve unit **65** has a tapered aperture **67** in one side thereof for reception of the usual detent on conventional cleaning implements to releasably maintain one end of such cleaning implement within outer portion **66**.

The inner end of flexible suction hose **28** is provided with sealing means, shown as a flexible annular gasket or piston **71** (FIGURE 5A) which surrounds and is connected to the outer wall of hose **28** and engages the inner wall of fixed conduit **21** to prevent the flow of air thereby. Spaced from sealing gasket **71**, and fixed on hose **28**, is an annular resilient wiper ring **72** which engages the inner wall of conduit **21** and, during movement of the hose, effectively removes any accumulated waste material tending to adhere to the conduit wall.

Located on outlet box **25** is a manually operable start-stop push button switch **73** which is pressed momentarily to start and stop the pneumatic cleaning system. An override push button switch **74** also may be mounted on outlet box **25** to permit use of the vacuum system as a blower, as will be later explained. A warning light or signal device **75**, which is visible through an opening **76** in the door **55** of outlet box **25** when it is closed, indicates when fan motor M and certain other electrical components of the system are energized.

It will be observed in FIGURE 16 that the push button start-stop switches **73** of all three outlet boxes **25**, **26**, **27** are arranged in parallel in the circuit, and the warning lights **75** and override switches **74** are arranged in respective series circuits. Thus, all the warning lights **75** are energized when any one of the switches **73** is pressed to start the system and while fan motor M is running. Further, the operation of the system may be independently manually controlled at any one of the outlet boxes.

To control restriction of the air flow through each cleaning hose **28**, **29**, the hand valve unit **65** on the outer end of each hose preferably is of cylindrical form and has a check valve member or clapper **81** (FIGURES 9-11) pivotally secured to an inner wall thereof. Clapper **81** normally is movable, in response to air flow outwardly along the hose, from an open position (FIGURE 11) to a closed position (FIGURE 9). A gasket or resilient seal **82** on one side of clapper **81** is engageable with a valve seat **83** on the cylindrical wall so that it may seal the outer end of the hose against the flow of air therethrough. Clapper **81** may be locked in closed position by the manually rotatable sleeve **84** which loosely sur-

rounds the cylindrical body of hand valve unit **65** and has an inwardly extending projection **85** thereon positioned in a spiral slot **86** in the wall of the hand valve body. By rotating sleeve **84**, projection **85** can be moved along slot **86** and into engagement with the face of clapper **81** (FIGURE 9) to hold the clapper **81** in closed or partially closed position when and as desired. Slot **86** may have straight portions at each end (FIGURES 11 and 12) to restrain projection **85** against accidental displacement in the slot until positive rotation of the sleeve is effected manually, and thus to insure that clapper **81** is locked in a closed position when projection **85** is in engagement with its free end portion.

The central control valve **33** is operative to alternatively and selectively direct air currents inwardly and outwardly along the collection conduits of the system, and the valve housing **37** thereof (FIGURES 13 and 14) defines a first or upper compartment **91**, separate portions of which are connected to fan outlet conduit **38** and exhaust conduit **39**. The first compartment **91** communicates, at times, with a second compartment **92** of housing **37** by means of an opening or passage **93**. Common collection conduit **24** is connected to one end of second compartment **92**, and air inlet conduit **36**, from collection chamber **34**, is connected to the opposite end of compartment **92**. Compartment **92** also has an auxiliary passage or opening **94** therein communicating with the atmosphere.

Supported between compartment **91**, **92** on a rotatable or pivot shaft **95**, is a double clapper **96** which is operative to occupy a first or "blow-out" position (FIGURE 13) providing communication between conduit **38** at the outlet side of fan **32** and the common collection conduit **24**, and also providing communication between the inlet conduit **36** of collection chamber **34** (FIGURE 3) and the atmosphere by way of opening **94** (FIGURES 13 and 14). Clapper **96** also is operative to occupy a second or "suction" position (FIGURE 14) providing communication between conduit **38** at the outlet side of fan **32** and exhaust conduit **39**, and also providing communication between common collection conduit **24** and the inlet conduit **36** of collection chamber **34**.

The electrical control device **41** embodies means to rotate clapper **96** of central control valve **33** between the aforementioned first and second positions and comprises a gear motor **101** (FIGURES 2, 15 and 16) provided with a cam **102** mounted on its drive shaft **103**. Pivot shaft **95** of double clapper **96** has a fixed crank arm **104** extending therefrom with a cam follower **105** thereon held in contact with cam **102** by means of a spring **106**. Spring **106** also biases double clapper **96** toward the "blow-out" position (FIGURE 13) when cam **102** moves away from follower **105**. Cam **102** has a projection **107** thereon which engages a spring lever **108** of a gear motor switch **109**. Switch **109** is normally biased toward open position and located in series with switches **74**, the operation of which will be later explained.

The control system of the pneumatic cleaning system may best be described by reference to the electrical circuitry of FIGURE 16. The electrical system may include a transformer **111** whose primary winding **112** is connected by a first set of conductors **113**, **114** to a primary power supply P. Fan motor M also is connected to power supply P by way of conductors **115**, **116**, **117** and a switch **118**. Conductors **115**, **119**, **121**, **122**, the manual override switches **74** and the gear motor switch **109** serve, at times, to connect gear motor **101** to power supply P. When any one or more of the normally closed override switches **74** are open, this prevents the gear motor switch **109**, when closed, from completing the circuit between gear motor **101** and the primary power supply P. However, during use of the system for suction cleaning, override switches **74** are closed.

The secondary winding **123** of transformer **111** supplies low voltage to the control components of the electrical system which actuate fan motor M and gear motor **101**. Switch **118** and a switch **129** are parts of an electromagnetic latching relay **124** whose coil is connected by conductors **125**, **126**, **127**, **128** and manual push button start-stop switches **73** to the secondary winding **123** of transformer **111**. As shown, switches **73** are connected in parallel to the coil of latching relay **124** so that, by manually pressing and closing any one or more of switches **73**, the coil of relay **124** is energized.

As will be later explained, with alternate closings of a switch **73**, relay **124** is activated and, with intervening closings of a switch **73**, relay **124** is inactivated. When relay **124** is active, switch **129** completes a circuit through conductors **131**, **132**, **133**, **127** to connect the outlet box warning lights **75** to the secondary winding **123** whenever fan motor M is energized.

When push button start-stop switch **73** on any one of outlet boxes **25**, **26**, **27** is closed, in addition to completing the circuit to the coil of latching relay **124**, a second circuit is also completed to a heating coil **135** of a vacuum tube delay-relay **136** through conductors **126**, **127**, **134**, and the secondary winding **123**. The delay interval of relay is determined by the time required to heat coil **135** sufficiently to close a pair of normally open contacts *a*, *b* in the vacuum tube of relay **136**. When closed, contacts *a*, *b* energize gear motor **101** through conductors **115**, **119**, **141**, **142** and **117**.

It should be noted however that a switch **73**, in order to energize motor **101**, must be held closed for a sufficient period of time to permit the heating coil **135** to close contacts *a*, *b* and move projection **107** on cam **102** away from spring lever **108** and close gear motor switch **109**. At this time switch **109** will take over to energize motor **101** and switch **73** may be released, allowing coil **135** to cool and permitting contacts *a*, *b* to open, breaking the initial circuit to the gear motor by way of vacuum tube relay **136**.

Gear motor **101** then continues to operate until cam **102** has completed a revolution and projection **107** again engages spring lever **108** to open switch **109**. As cam **102** moves away from cam follower **105**, spring **106** moves double clapper **96** of central control valve **33** to the "blow-out" position of FIGURE 13, thus establishing communication between the outlet side of fan **32** and the common conduit **24** to direct blowing air into, or produce positive air pressure in, collection conduits **21–23**.

The operation of latching relay **124** can best be described by reference to FIGURES 17 and 18. Assuming relay **124** is inactive as shown in FIGURES 16 and 17, when any one of the push button switches **73** is actuated manually to energize the coil of relay **124**, a magnet **151** attracts and draws a pivoted spring-biased armature **152** into contact therewith. A projecting finger or trigger **153** on armature **152** is thus moved against a downwardly extending spring-biased keeper **154** to displace it in FIGURE 17 from engagement with the end of a projection **155** on a spring-biased pivotally mounted latch **156**. Such displacement of keeper **154** moves a switch contact point **157** of each switch **118**, **129** into engagement with a respective fixed switch contact point **158** to close each switch **118**, **129**. When the corresponding push button switch **73** is released to break the circuit to the coil of relay **124**, armature **152** moves away from magnet **151**, but the downwardly extending keeper **154** is retained by projection **155** to lock the switch contact in closed position as in FIGURE 18.

To open switches **118**, **129** thereafter, any one of the push button switches **73** is again pressed and held closed momentarily to again move armature **152** into engagement with magnet **151**, whereupon trigger **153** engages projection **155** to displace latch **156** and permit keeper **154** to move in response to the spring **154***a* and thereby open the contacts **157**, **158** of each switch **118**, **129**.

Method of operation

For the purpose of description of the method of operation of the cleaning system, it will be assumed that flexible hoses **28**, **29** occupy the positions shown in FIGURES 1, 4, 5 and 5A and that the clapper operating projection **85** of each hand valve unit **65** occupies the inactive position of FIGURE 11. Further, it is to be assumed that clapper **96** of central control valve **33** occupies the "suction" position of FIGURES 14 and 15. Thus, upon the operator momentarily closing the push button switch **73** of any one of the outlet boxes **25–27** for a sufficient period of time to activate relay **136**, fan motor M and gear motor **101** are successively energized in the manner heretofore described.

Initially, suction pressure will be present in all of the collection conduits **21–23**, and the clapper **81** of each hand valve unit **65** will thus occupy the open position of FIGURE 11. However, when cam **102** (FIGURE 15) moves out of engagement with follower **105**, spring **106** moves double clapper **96** to the "blow-out" position of FIGURE 13, thus producing a blowing or positive pressure in each conduit **21–23**.

Assuming that the doors **55** of outlet boxes **26**, **27** are closed, the operator opens door **55** of outlet box **25**, withdraws the hand valve unit **65** of the hose therefrom, and rotates sleeve **84** of the hand valve which is stored in the outlet box with clapper **81** in locked position, to unlock the face of clapper **81**. Switch **73** of the outlet box **25** is then actuated to start motor M, fan **32**, and gear motor **101** to produce positive pressure in the conduits **21–23** of the system. The closed door **55** of outlet box **26** seals the outlet against the escapement of blowing air and thus restrains the hose **29** against being forced outwardly through the outlet box. Due to the positive pressure produced in the conduits, the valve clapper **81** of hose **28** will be moved to the closed position of FIGURE 9.

The positive air pressure in conduit **21** will thus extend or impart outward movement to flexible hose **28** through outlet box **25** until wiper ring **72** engages the inner end of receptacle **61** of FIGURE 5, or until the cam **102** of FIGURE 15 again engages follower **105** and returns double clapper **96** to the "suction" position of FIGURE 14, whichever occurs first. Thus, suction pressure is again produced in each conduit **21–23** by fan **32**, and this causes the clapper **81** of the hand valve unit **65** on hose **28** to open (FIGURE 11). The operator may then insert into and connect one end of any desired cleaning implement to the outer end portion **66** of the hand valve unit **65** on flexible hose **28** to clean the desired area or surfaces by suction.

At any time after hose **28** has been extended in the manner last described, the operator may partially or fully close the corresponding clapper **81** by rotating sleeve **84** (FIGURES 9–11) relative to the body of the hand valve unit **65**, whereupon the negative or suction pressure in conduit **21** will retract the hose **28** into conduit **21** where it is stored with the hand valve **65** in a locked, closed position, as seen in FIGURE 9. Of course, if the operator wishes to retract only a relatively short length of the hose **28** into conduit **21**, the operator returns sleeve **84** to the position of FIGURE 11 at any desired instant and may then resume the suction cleaning operation.

Although the operator may desire to leave the hose partially extended and then deenergize fan motor M, the hose normally would be fully retracted into the corresponding outlet box **25** and conduit **21** before denergizing fan motor M.

The fan motor M is deenergized, when desired, simply by momentarily actuating the adjacent push button switch **73** to inactivate latching relay **124**, thereby opening switches **118**, **129**. Normally, the operator would only hold the corresponding switch 73 is closed position for a very short time when stopping motor M, so the heating coil **135** (FIGURE 16) would not heat sufficiently to close contacts *a*, *b* of relay **136**, and thereby avoiding energizing gear motor **101** at that time. However, in the event that the corresponding switch **73** were held closed for a sufficient period to cause contacts *a*, *b* to close, gear motor **101** would simply complete a cycle and then cease rotating if the corresponding switch **73** has been released. The method of operation then could be repeated substantially as heretofore described.

As stated earlier, in addition to being used for suction cleaning, the cleaning system of the present invention also may be used for blowing cleaning; i.e., for blowing lint, dust and the like off of surfaces to be cleaned, or for operating various pneumatic implements such as paint sprayers, deodorant sprayers, etc. When the operator wishes to utilize the cleaning system as a blower, the operator need only open an override switch **74** associated with any one of the outlet boxes **25–27** to thereby render switch **109** ineffective to energize motor **101** in the normal manner heretofore described.

Thereupon, the desired push button start-stop switch **73** may be closed by the operator to effect energization of fan motor M and gear motor **101** and thus effect extension of the corresponding flexible hose (hose **28** in this instance) in the manner heretofore described. However, motor **101** is only energized during a partial revolution of cam **102** driven thereby because, when the contacts *a*, *b* of vacuum tube relay **136** are permitted to open by the cooling of heating coil **135** consequent to the opening of switch **73**, gear motor **101** will no longer be energized, even though switch **109** will have been released and moved to closed position as the projection **107** on cam **102** moved out of engagement with arm **108**. This is due to the fact that gear motor switch **109** is in series with all the override switches **74**.

It follows that, when the operator has held a push button start-stop switch **73** closed for a sufficient period of time to insure that cam **102** has moved out of engagement with follower **105**, and then releases the corresponding switch **73**, cam **102** will remain in the position last described and spring **106** then urges double clapper **96** of central control valve **93** to the "blow-out" position of FIGURE 13. The double clapper **96** thus remains in the "blow-out" position, but since the clapper **81** of the corresponding hand valve unit **65** is then held in closed position by the positive pressure in the corresponding flexible hose, means is provided for maintaining the hand valve clapper **81** in open position while the corresponding flexible hose is being used as a blower.

As shown in FIGURE 12, the means for maintaining the hand valve clapper **81** in open position, in opposition to the blowing air current in the flexible hose, may take the form of a blowing adapter member or attachment **160** and may comprise an elongate cylindrical body **161** adapted to fit in the outer end portion of the corresponding hand valve unit **65** in place of the usual suction cleaning elements used with the hand valve unit **65**.

Blowing adapter member **160** may be releasably secured in the corresponding hand valve unit **65** by means of a spring-biased detent **162** which enters aperture **67** in the wall of the hand valve body. Other implements may be conveniently connected to the outer portion of cylindrical body **161** or the blowing adapter member **160**, per se, may serve also as a cleaning implement or the like by providing a tapered nozzle portion **163** on the outer end of the body **161** as shown in FIGURE 12, thus providing a relatively small air discharge nozzle opening **164** on the outer end of cylindrical body **161**. In order to maintain clapper **81** in open position, the inner end of cylindrical body **161** may be partially closed and has a relatively small tubular portion **165** communicating therewith in eccentric relation to the body **161**, and which fits within the opening defined by valve seat **83** so as to engage and move clapper **81** to open position when the body **161** is inserted manually in the outer end **66** of the

corresponding hand valve unit **65**. Thus, the reduced tubular portion **165** will maintain clapper **81** in the open position during use of the system as a blower.

It is apparent that, following the use of the system as a blower, adapter **160** may be removed from the corresponding hand valve unit **65** and the previously opened override switch **74** may be closed to return cam **102** and central control valve clapper **96** to the positions shown in FIGURES 14 and 15. Thereupon, the system may be used further as a suction system or the corresponding flexible hose may be returned to stored position in the corresponding collection conduit in the manner heretofore described, after which any one of the switches **73** may be closed momentarily to stop fan motor M.

Various other timing mechanisms may be used to regulate central control valve **33** and to maintain double clapper **96** in the "blow-out" position without departing from the scope of the invention. By utilizing the disclosed gear motor **101** and cam **102**, the size of the cam and speed of rotation of the gear motor may be varied to hold the control valve clapper **96** in the "blow-out" position for different periods of time to extend desired amounts of hose from an outlet box prior to moving the valve clapper **96** to the suction position.

By utilizing a check valve, such as clapper **81**, on the outer end of each hose **28, 29**, it is not necessary to manually open the valve exactly when the extension of the hose is complete, since the valve will automatically open upon reversal of the air flow in the conduits as effected by cam **102** and clapper **96**.

The bleeder valves are provided to control the rate of extension of the flexible hoses **28, 29** from their associated outlet boxes **25, 26**. The bleeder valves **31** in conduits **21, 22** are preferably located at points intermediate the length of the respective suction hoses **28, 29** when they are in retracted position. Each bleeder valve is a form of check valve and may comprise a T-shaped pipe fitting (FIGURE 6) having an eccentrically positioned opening **171** in the branch leg **172** thereof. Rotatably secured by a pin **173** in the branch leg **172** is a plate or disc **174** having an eccentric opening **175** therein adapted to register with opening **171**.

A flexible clapper element or flap **176** is secured to the exposed side of disc **174**, as by a brad **177**, and overlies opening **175** thereof to prevent the inward flow of air therethrough. By adjustably rotating disc **174** so that its opening **175** partially or completely registers with a portion of opening **171**, the discharge of air therethrough can be varied, thus varying the positive pressure in the associated conduit and hose.

By positioning bleeder valves **31** intermediate the length of hoses **28, 29** (FIGURE 1), these bleeder valves have no effect upon the initial rate of movement of each hose from its retracted position by positive pressure in the corresponding conduit. However, as the sealing gasket or piston **71** (FIGURE 5A) on the end of either hose **28, 29** passes a bleeder valve **31**, the corresponding bleeder valve permits some air pressure to escape from the respective conduit **21** or **22** to decrease the pressure exerted against the hose and thereby reduce its rate of outward movement. A reduced speed of extension of the hose may be particularly desirable where an outlet box of the system is positioned at the lower end of a conduit as is the case with outlet box **26** in FIGURE 1, or where an outlet box occupies an overhead position, such that the weight of the hose assists in its extension. The bleeder valve **31** in the common collection conduit (FIGURE 1) adjacent enclosure A may be desirable in instances in which it is desired to regulate the positive pressure which may be effective in the entire vacuum cleaning system. However, suction pressure in the conduits holds each flap **176** in closed position so there is no inward flow of air through the corresponding bleeder valve.

The flexibility of wiper ring **72** and seal **71** is such that, although they may normally prevent each hose **28, 29** from being blown entirely out of the respective outlet box **25, 26** by engaging the inner end of the corresponding tubular receptacles **61** (FIGURES 4, 5, 8 and 9), an operator may readily distort and/or compress the ring **72** and seal **71** on either hose **28, 29** by manually twisting and/or pulling on the hose to force the ring and seal through the restricted inner end of the corresponding receptacle and to thereby remove the entire hose from the corresponding receptacle and outlet box. This may be desirable in the event that one or more outlet boxes, such as outlet box **27** (FIGURE 1) and its conduit **23**, is not equipped with its own hose and one of the hoses **28, 29** is to be used at such outlet box **27**.

In the drawings and specification there have been set forth preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. A method of manipulating a flexible suction hose positioned for longitudinal movement within a conduit of a vacuum cleaning system and capable of telescopic retractable storage within the confines of the conduit with its outer end proximate the conduit outlet, said method comprising the steps of:

(a) creating a pressure in said conduit above atmospheric pressure, and

(b) extending the hose outwardly of the conduit outlet into an area to be cleaned under the influence of the pressure.

2. A method as defined in claim **1** including the subsequent steps of:

(a) changing the pressure in said conduit to provide a reduced pressure below atmospheric pressure, and

(b) retracting the suction hose from its extended position in said area telescopically into said conduit for storage under the influence of the reduced pressure.

3. A method as defined in claim **1** wherein the step of creating a pressure above atmospheric in said conduit includes the steps of:

(a) initiating a flow of air outwardly along said conduit toward its outlet, and

(b) restricting the outward flow of air through the flexible suction hose.

4. A method as defined in claim **2** wherein the step of changing the pressure in the conduit to a reduced pressure includes the steps of:

(a) initiating a flow of air in said conduit and hose in a direction away from the outlet of the conduit, and

(b) restricting the flow of air through the flexible suction hose.

5. A method of manipulating a flexible suction hose normally telescopically retractably stored within a conduit of a vacuum cleaning system, said hose having an outer end located adjacent an outlet of said conduit when in retracted position and an inner end located within said conduit, said method comprising the steps of:

(a) directing air flow in said conduit in a first direction toward its outlet,

(b) restricting the outward flow of air through the outer end of said hose to create a positive pressure in the conduit and longitudinally extend the hose from the outlet of the conduit,

(c) reversing the direction of air flow in said conduit while permitting substantially unrestricted flow of air into and through said hose to create suction currents therethrough for cleaning, and

(d) restricting the inward flow of air through the outer end of the hose to create a negative pressure in said conduit and retract said hose telescopically into said conduit for storage.

6. A vacuum cleaning system having a retractable and extensible flexible suction hose telescopically positioned within and normally retractably stored within a conduit of the system with an outer end of the hose proximate the conduit outlet, and means associated with the system for producing a positive pneumatic pressure in said conduit to extend the suction hose from the outlet of the conduit into an area to be cleaned.

7. A vacuum cleaning system as defined in claim 6 wherein said means is also operative to produce a negative pneumatic pressure in said conduit to retract the hose into the conduit for storage.

8. A vacuum cleaning system as defined in claim 7 wherein said telescopically positioned vacuum hose has an inner end movable longitudinally in said conduit, sealing means associated with said inner end to substantially prevent the flow of air between the outer wall of said hose and the inner wall of said conduit, whereby said sealing means acts as a piston surface on said hose to assist in moving said hose longitudinally in said conduit in response to pneumatic pressure in the conduit.

9. A vacuum cleaning system as defined in claim 8 wherein said sealing means includes a flexible gasket surrounding said hose and engaging with the inner wall of said conduit, and wiper means positioned on said hose and spaced from said gasket to contact the inner wall of said conduit to remove accumulation of waste material thereon during extension and retraction of the hose.

10. A vacuum cleaning system as defined in claim 7 wherein said pneumatic pressure producing means includes an air impeller communicating with an inner end of said conduit, control means operatively associated with said air impeller for selectively directing air flow produced thereby in a first direction outwardly of said conduit toward said conduit outlet and in a second direction inwardly of said conduit away from said conduit outlet, and means associated with the hose for restricting the flow of air therethrough to create said positive pressure during said outward flow of air and said negative pressure during said inward flow of air.

11. A vacuum cleaning system as defined in claim 10 wherein said control means includes a valve located in said conduit and movable between a first position connecting the outlet of said air impeller to said conduit to direct air currents in said first direction, and a second position connecting the inlet of said air impeller to said conduit to direct air currents in said second direction, and means for retaining said valve in said first position for a predetermined period of time to extend the hose from the conduit when the flow of air through the hose is restricted and for thereafter automatically moving the valve to said second position to produce suction currents through said conduit for cleaning.

12. A vacuum cleaning system as defined in claim 10 wherein said restricting means is located on the outer end of the hose and is arranged to close said outer end in response to outward movement of air therethrough and to open said outer end in response to inward movement of air therethrough, and manually manipulable means to retain said outer end closed.

13. A vacuum cleaning system as defined in claim 12 including means associated with said restricting means to prevent closure of the outer end of said hose during the passage of air outwardly therethrough, whereby said vacuum cleaning system may be used to blow air into an area.

14. A vacuum cleaning system as defined in claim 10 including bleed valve means in said conduit located intermediate its length to vary positive pneumatic pressure in said conduit to control the speed of extension of said hose from the conduit outlet.

15. A vacuum cleaning system as defined in claim 14 wherein said bleed valve means is also located intermediate the length of said hose when the hose is in retracted position in said conduit to reduce the speed of movement of said hose during extension from the conduit after its initial outward movement.

16. A vacuum cleaning system having a retractable and extensible flexible suction hose telescopically positioned within and normally retractably stored within a conduit of the system, with the outer end of said hose adjacent an outlet of the conduit, means for creating an air flow in said conduit, control means associated with said conduit for selectively directing said air flow in a first direction toward the outlet of the conduit, and in a second direction away from the outlet of the conduit, and means associated with the hose for restricting the flow of air therethrough to create pneumatic pressure in said conduit sufficient to extend the hose from and retract the hose into the conduit for respective use and storage.

17. A vacuum cleaning system as defined in claim 16 including at least on additional conduit having an outlet and an additional flexible suction hose telescopically positioned and normally retractably stored therein, said additional hose having means associated therewith for restricting the flow of air therethrough, and wherein each of said conduits is provided with means for sealing the outlet thereof when not in use, and wherein said means for creating an air flow in said conduit and said control means are also associated with the additional conduit for selectively directing the flow of air therethrough when said additional conduit and hose are in use.

18. A vacuum cleaning system as defined in claim 17 wherein said control means includes means located at each outlet of said conduit and said additional conduit for independent operational control of the vacuum cleaning system.

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15—315; 137—355.23, 355.16; 134—37

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,464,859 Dated Issued September 2, 1969

Inventor(s) J. C. Hamrick

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

The assignee should be --Jet Line Products Incorporated-- instead of "J L Products Incorporated". Column 7, Line 74, "is" should be --in--.

SIGNED AND
SEALED
FEB 17 1970

(SEAL)
Attest:

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