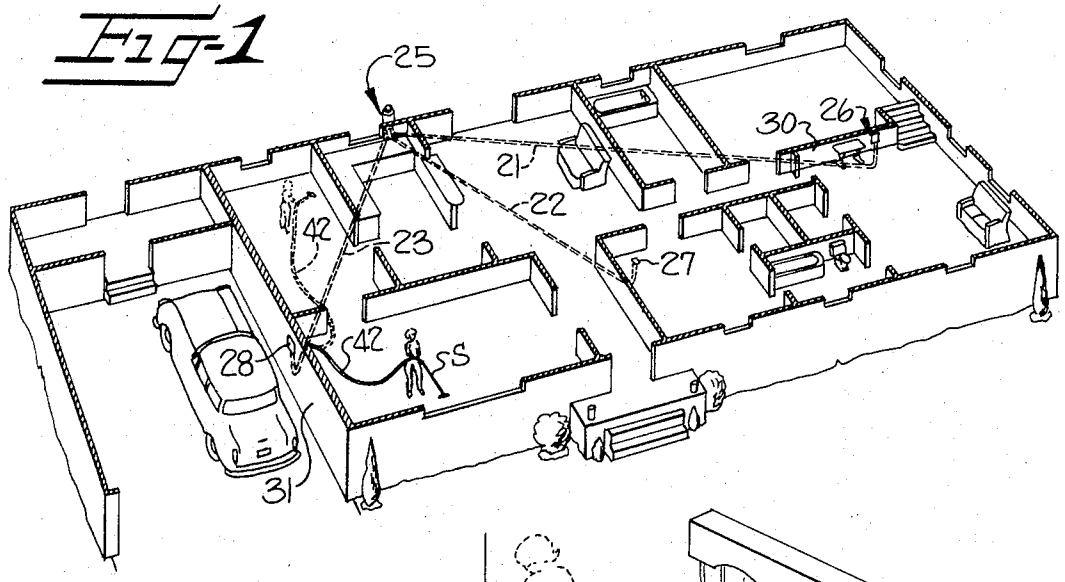
Nov. 21, 1967 J. C. HAMRICK 3,353,996

SUCTION CLEANING SYSTEM AND METHOD

Filed May 24, 1965 4 Sheets-Sheet 1

Fig-1



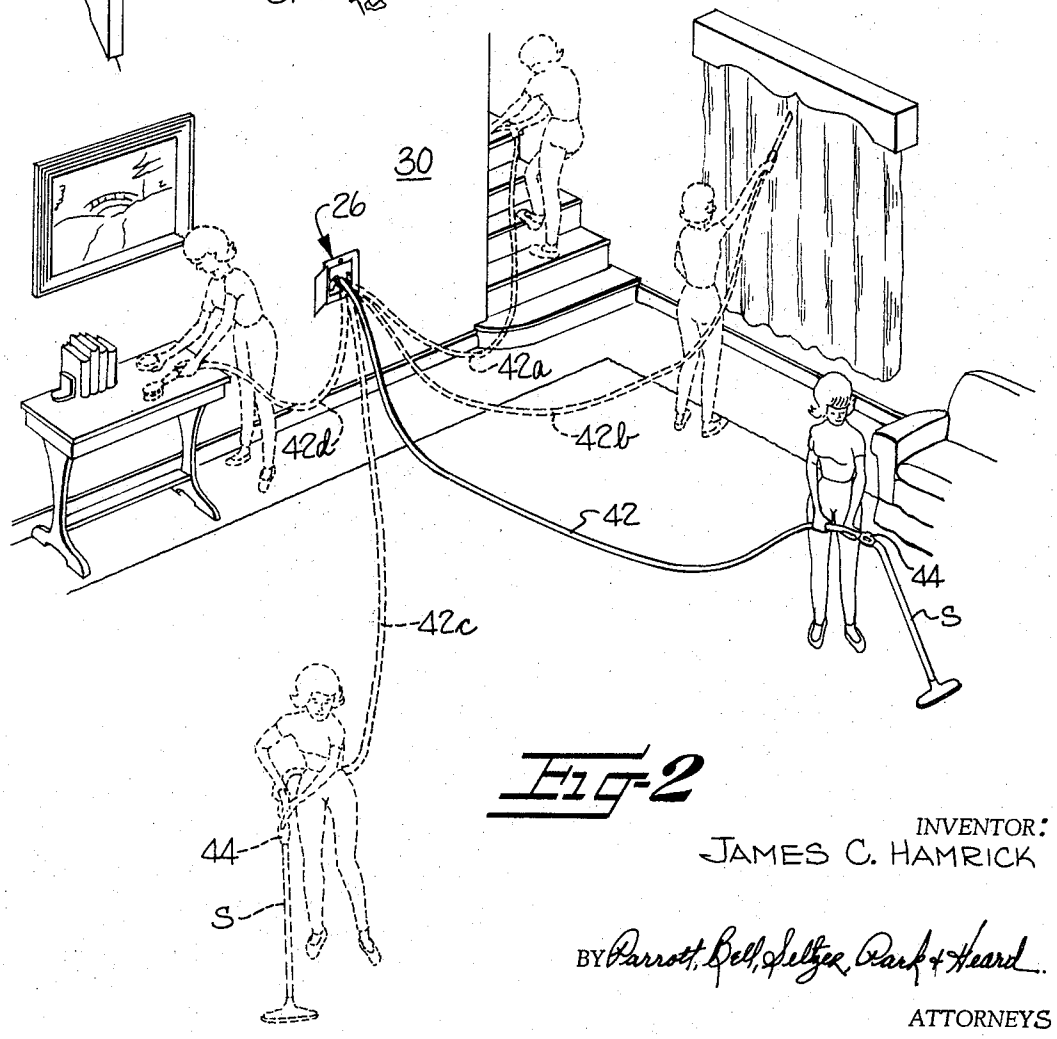


Fig-2

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Nov. 21, 1967 J. C. HAMRICK 3,353,996

SUCTION CLEANING SYSTEM AND METHOD

Filed May 24, 1965 4 Sheets-Sheet 2

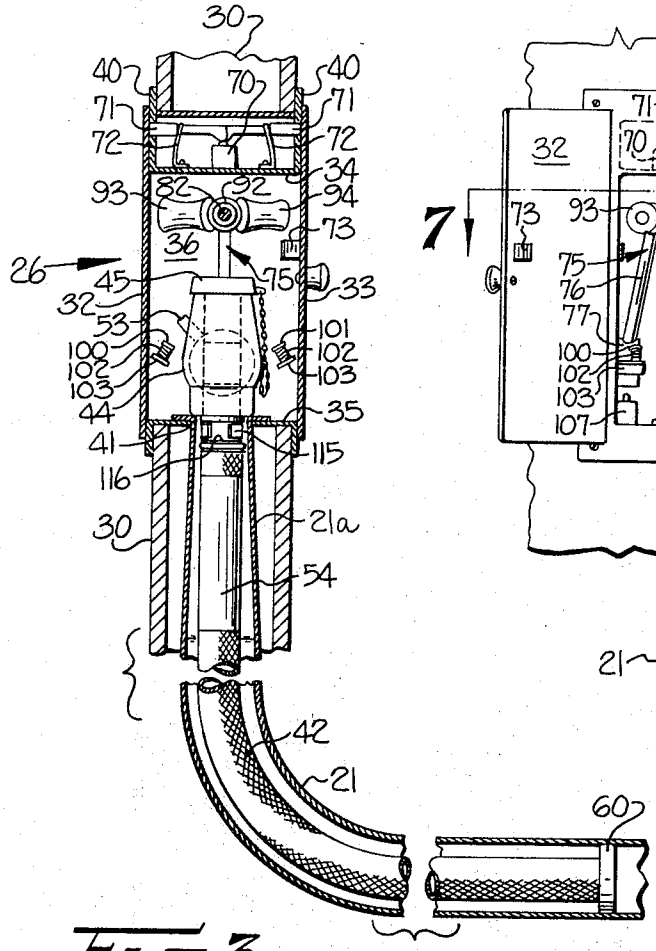


Fig-3

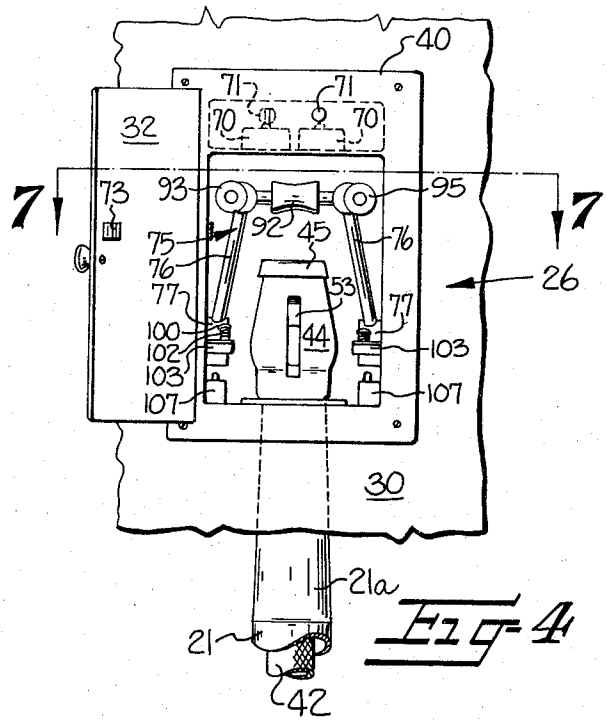


Fig-4

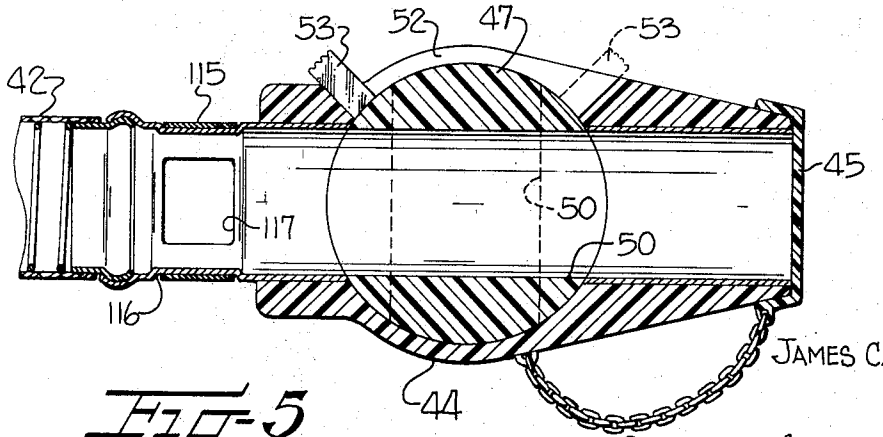


Fig-5

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SUCTION CLEANING SYSTEM AND METHOD

Filed May 24, 1965 4 Sheets-Sheet 3

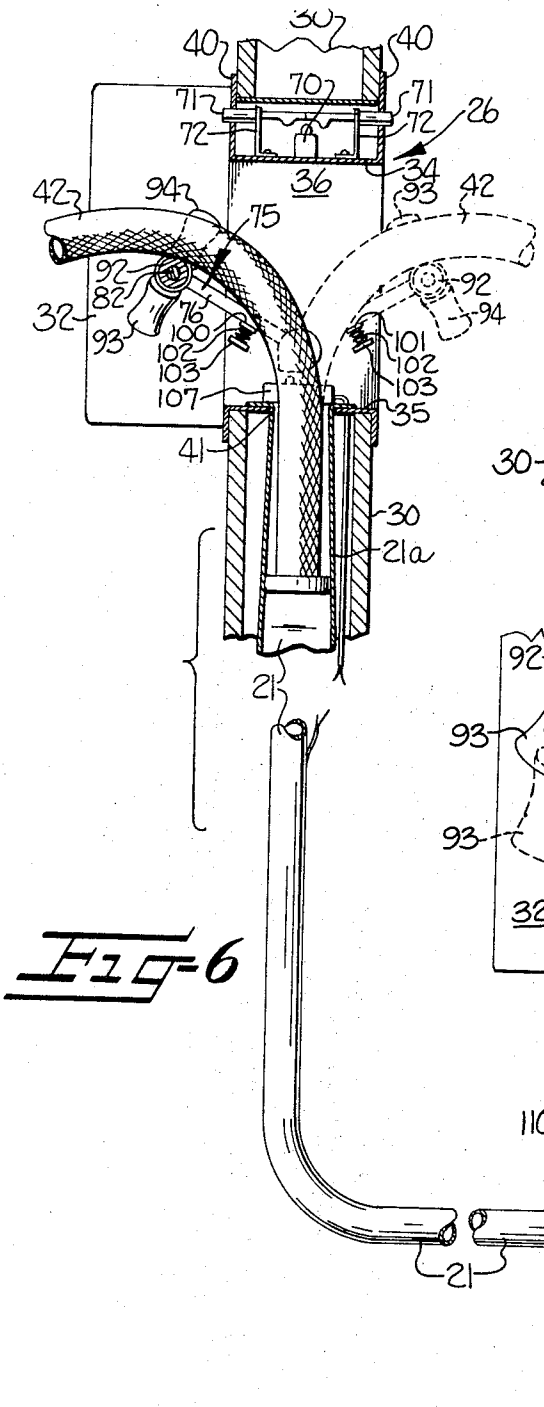


Fig-6

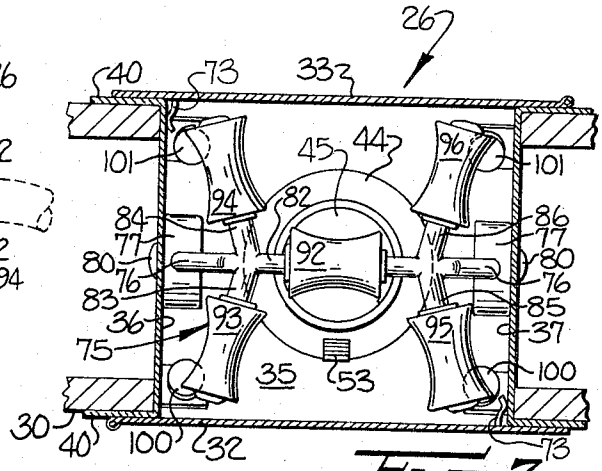


Fig-7

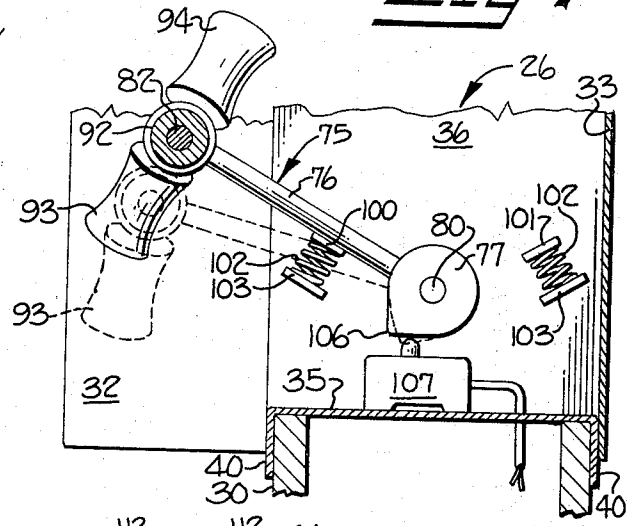


Fig-8

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Nov. 21, 1967 J. C. HAMRICK 3,353,996

SUCTION CLEANING SYSTEM AND METHOD

Filed May 24, 1965 4 Sheets-Sheet 4

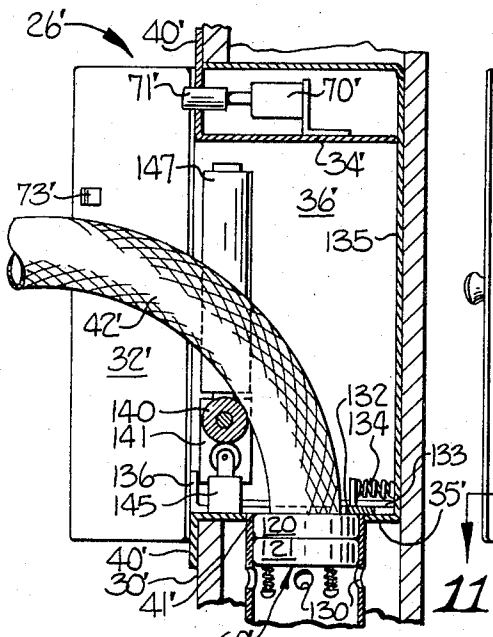


Fig-9

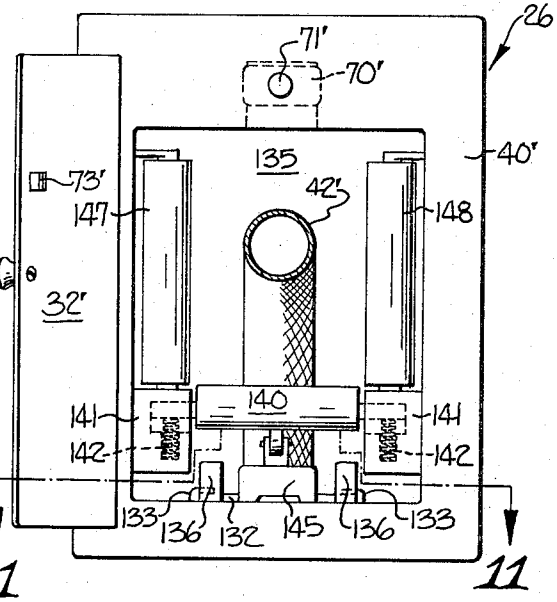


Fig-10

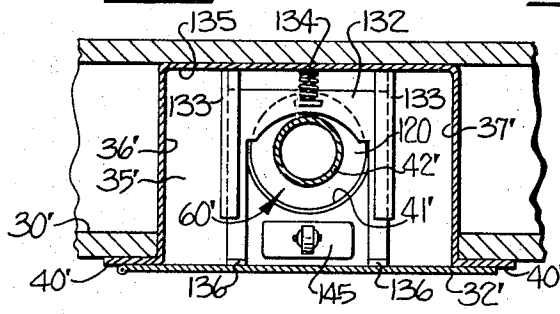


Fig-11

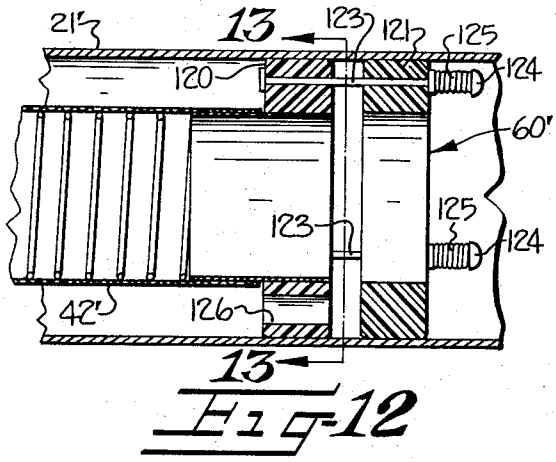


Fig-12

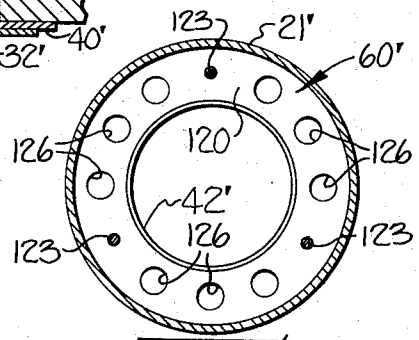


Fig-13

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United States Patent Office 3,353,996 Patented Nov. 21, 1967

3,353,996

SUCTION CLEANING SYSTEM AND METHOD

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Filed May 24, 1965, Ser. No. 458,178
20 Claims. (Cl. 134—21)

ABSTRACT OF THE DISCLOSURE

A suction cleaning system and method of operation wherein the system has a conduit communicatively connected to a source of suction, with an elongate pliable hose normally stored within the conduit, and arranged to have any desired length thereof withdrawn from the conduit for reaching the area to be cleaned, and wherein upon completion of the cleaning operation the withdrawn length of hose is retracted into the conduit for storage under the impetus of the suction from the source by restricting the flow of the suction current from the hose into the conduit by manipulation of a valve positioned adjacent the extended end of the hose.

This invention relates to centralized suction or vacuum cleaning systems and more especially to a new and novel method of and apparatus for storing and manipulating a suction cleaning tube or hose.

A typical prior art centralized suction cleaning system has several outlets at spaced locations in the walls or floors of a building from which permanently installed stationary conduits extend to a common suction and filtering device so one end of a flexible tube usually about thirty feet long may be detachably connected to selected outlets as its other end, or a suction cleaner attachment thereon, may be manipulated to suck dirt, lint and other foreign particles or objects off surfaces to be cleaned.

Further, prior art patents disclose a suction hose telescopically mounted within a stationary conduit for ease in storage of the hose when not being used. However, these systems necessitate manual manipulation of the hose to move the same to retracted position within the conduit or reliance on suction forces applied to a seal carried by the inner end of the hose and engaging the conduit and serving as a piston.

However, this piston arrangement is only effective when used with short lengths of hose, otherwise the frictional engagement of long lengths of hose against the floor surface is too great to be overcome by the suction forces. Further, this piston arrangement to be practical with short lengths of hose necessitates the use of hose latching means to latch the hose in extended position to offset the suction pulling forces on the hose which would otherwise interfere with the manipulation thereof during cleaning.

With the foregoing in mind, it is the primary object of this invention to provide a suction cleaning system and method in which a suction hose of the desired length is normally stored within a stationary conduit and which may be partially or fully extended and wherein the hose may be so controlled 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.

Generally, in its preferred embodiment, the apparatus of the present invention comprises at least one stationary suction conduit extending from a suction device to an outlet box mounted in the floor or wall of a building with a pliable suction cleaning tube telescopically mounted in the suction conduit so the desired length of the suction tube may be manually withdrawn to perform the desired cleaning. Means are provided for automatically reducing the inward pulling force exerted on the tube by the suction device whenever the suction tube is being withdrawn without interrupting operation of the suction device and, although suction in the conduit is normally sufficient to retract short lengths of the withdrawn suction tube into the conduit, means are provided adjacent the working end of the conduit, and readily accessible to the operator, for selectively restricting the flow of fluid from the suction tube into the conduit sufficiently to retract any desired length of the tube at the desired speed, thus obviating the necessity of excess portions of the tube laying on the floor where they would be in the way of the operator and might cause the operator to trip over the same and could result in injury to the operator. Further, by retracting excess portions of the suction tube while it is in use, coiling and kinking of the suction tube, with consequent reduction in efficiency, is avoided.

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 perspective view of a representative installation of the suction cleaning system of the present invention in a typical building;

FIGURE 2 is a perspective view showing how the operating end of the pliable suction hose may be used at different locations and at various distances from an outlet box in the wall of a room while having only so much of the hose extended from the outlet box as is needed to perform the particular cleaning operation;

FIGURE 3 is a fragmentary vertical sectional view through a portion of a building wall or room partition showing one form of outlet box with a storage suction conduit connected thereto and within which a corresponding pliable suction hose is shown in fully retracted or stored position;

FIGURE 4 is a fragmentary elevation looking at the left-hand side of the upper portion of FIGURE 3 with the corresponding door of the outlet box occupying open position;

FIGURE 5 is an enlarged fragmentary detail showing the working end of the suction hose provided with a preferred form of valve means thereon for selectively restricting the flow of fluid into the suction hose for effecting retraction of the hose at the will of the operator;

FIGURE 6 is a view similar to FIGURE 3 showing an end of the storage conduit remote from the outlet box connected to a suction device and also showing the suction hose fully extended outwardly from one side of the outlet box in solid lines and showing the same in phantom lines projecting outwardly from the other side of the outlet box;

FIGURE 7 is an enlarged fragmentary sectional plan view taken substantially along line **7—7** in FIGURE 4 with both of the doors to the corresponding outlet box being shown in closed position;

FIGURE 8 is an enlarged fragmentary view of the suction hose guiding device shown in the left-hand portion of FIGURE 6;

FIGURE 9 is an enlarged fragmentary view similar to the upper portion of FIGURE 6, but showing another form of outlet box and also showing a different type of piston or seal arrangement on the inner end of the suction hose;

FIGURE 10 is an elevation looking at the left-hand side of the outlet box in FIGURE 9;

FIGURE 11 is a fragmentary sectional plan view taken substantially along line **11—11** in FIGURE 10;

FIGURE 12 is a longitudinal sectional view through the piston arrangement of FIGURE 9 but showing the same in a different portion of the suction conduit from

that shown in FIGURE 9 and with its two annular members spaced apart; and

FIGURE 13 is a transverse sectional view taken along line **13—13** in FIGURE 12 and showing further details of the piston arrangement.

Referring more specifically to the drawings, a typical installation of the suction cleaning system of the present invention is shown in association with a residential building and wherein a plurality of stationary suction conduits **21, 22, 23** extend from a common suction device generally designated at **25**. Suction device **25** is preferably positioned exteriorly of the building, and conduits **21, 22** and **23** may extend beneath the floor or over the ceiling of the building, as desired. In this instance, suction conduits **21, 22, 23** are shown extending beneath the floor of the building and then upwardly to respective outlet boxes **26–28**. Outlet box **26** is shown positioned within a partition **30**, outlet box **27** is shown positioned in the floor of the building and outlet box **28** is shown within an outside wall **31** of the building, by way of example only.

That portion of the suction cleaning system associated with outlet box **26** and partition **30** of FIGURE 1, for example, is shown in detail in FIGURES 3–8 wherein it is shown in the form of a substantially rectangular tubular housing having top and bottom walls **34, 35** and opposed side walls **36, 37** which fit in a suitable opening formed in partition **30** and are provided with flanges **40** which straddle partition **30** and are suitably secured thereto. Outlet box **26** may be closed at opposite open sides thereof by suitable doors **32, 33** hingedly or otherwise mounted on corresponding flanges **40**.

The outlet or open mouth end **41** of conduit **21** extends through and is suitably secured to bottom wall **35** of outlet box **26** and has an extensible and retractable flexible suction tube or hose **42** therein and extending longitudinally thereof. Hose **42** is preferably of well-known type having a smooth, rather than corrugated, outer peripheral surface.

The outer or working end of suction hose **42**, when fully retracted, projects outwardly from the outlet end **41** of suction conduit **21** and has an enlarged tubular fitting **44** mounted thereon whose inner portion may be of greater dimension or diameter than the outlet end of conduit **21** so that it may rest upon the outlet end of conduit **21** when suction hose **42** is fully retracted, as shown in FIGURE 3. While hose **42** is fully retracted, tubular fitting **44** may be closed by a removable cap **45**. When in use, conventional vacuum cleaning implements may be inserted in fitting **44**. A floor sweeper S, representative of such implements, is shown connected to the hose **42** in solid lines in FIGURES 1 and 2.

Tubular fitting **44** is shown in FIGURES 3, 4 and 5 in the form of a valve housing having a transverse cylindrically or ball shaped valve member **47** mounted for angular movement therein and which is provided with a diametrically extending passageway **50** therethrough whose diameter is preferably about the same as the internal diameter of suction tube **42**. Passageway **50** is axially aligned with suction hose **42** at least while the suction tube is in use. Valve member **47** serves as a manually operable means for partially or entirely restricting the flow of fluid or air into suction hose **42** and thus to partially or fully restrict the flow of fluid from the inner end of the hose **42** into conduit **21** so as to render existing suction in conduit **21** effective to retract suction hose **42**.

Therefore, tubular fitting **44** has a longitudinally extending slot **52** in one side thereof through which a control pin **53** loosely extends and which pin is suitably secured to or formed integral with a medial portion of valve member **47**. When pin **53** occupies the position of FIGURE 5 against one end of slot **52**, valve member **47** occupies fully open position and, when an operator moves pin **53** to the broken line position of FIGURE 5, valve member **47** then occupies fully closed position.

It will be noted that the valve assembly thus formed by fitting **44** serves as a means adjacent the free end of suction hose **42** and within easy reach of the operator for controlling the flow of fluid into suction hose **42**. As a further convenience to the operator to restrict the flow of air into suction hose **42**, the suction hose **42** may have a short section **54** of easily compressible material interposed therein adjacent the working end of suction tube **42**. Thus, to restrict air flow through suction hose **42**, the operator may squeeze and thereby partially or fully constrict the compressible section **54** and/or the valve member **47** may be partially or fully closed.

In order that suction hose **42** may be up to thirty feet or more in length and may be fully retracted solely by the impetus of the existing suction in conduit **21** effected by suction device **25**, the inner end of suction hose **42** may be provided with an enlarged portion, piston or seal **60** thereon which may be mounted for sliding engagement with the inner surface of conduit **21**. However, it has been determined that an enlargement or piston on the inner end of hose **42** is not required in some installations, particularly wherein the outside diameter of hose **42** is only slightly less than the inner diameter of suction conduit **21**.

Suction device **25** may include a suction tank or collection box **62** having a filter **63** in its upper portion above which a suction fan or air impeller **65** is positioned, the impeller being driven by an electric motor **66**. The energization and deenergization of motor **66** may be effected at outlet box **26** or at any of the outlet boxes of the central cleaning system such as by means of switches **70** arranged in parallel in an electrical circuit to motor **66** and controlled by push-buttons **71** accessible from either side of partition **30** (FIGURES 3 and 4). As shown in FIGURES 3, 4 and 6, push-buttons **71** may be normally biased outwardly through the upper flanges **40**, by suitable springs **72**, so as to be engaged and depressed by doors **32, 33** as they are closed to operate switches **70** and stop motor **66**. Any suitable catch, latch means, or spring means **73** may be provided for releasably holding the doors in closed position when suction hose **42** is not in use. Switches **70** may be of any suitable type which will energize motor **66** when either door **32, 33** is opened and will deenergize motor **66** when both doors **32, 33** are closed.

At all times during which suction device **25** is operating at its normal efficiency, the inner end of suction hose **42**, as represented by piston **60**, is subject to the pulling force of the suction thus effected in conduit **21**. Thus, in order to facilitate ease in withdrawing suction hose **42** from the outlet end **41** of conduit **21**, means are provided for interrupting or reducing the suction in conduit **21** during such withdrawal of suction tube **42** therefrom, one embodiment of such means being shown in FIGURES 3, 4, 6, 7 and 8. The suction relieving means is shown in these figures in the form of an inverted substantially U-shaped suction tube guide or bracket **75** including opposite side portions or legs **76** which normally straddle the upper portion of valve assembly **44** when suction hose **42** is in stored position within conduit **21**.

The lower ends of legs **76** are pivotally connected to opposed side walls **36, 37**. To this end, each leg **76** is fixed to and projects upwardly from a collar **77** journaled on the corresponding side wall of outlet box **26**, as at **80** (FIGURE 8). The distal surfaces of collars **77** may frictionally engage the proximal surfaces of side walls **36, 37** to assist in normally maintaining the legs of the suction tube guide **75** in upright position, as shown in FIGURES 3 and 4, when the suction hose **42** is completely stored in conduit **21**. The upper or free ends of legs **76** are interconnected by a bridging portion **82** whose opposed ends have respective pairs of outwardly diverging arms **83, 84** and **85, 86** thereon. Bridging portion **82** and arms **83–86** have respective concave rollers **92–96** journaled thereon.

When the operator is about to partially or fully with-

draw suction hose 42 from conduit 21, the upper end of the suction tube guide or bracket 75 is swung downwardly and outwardly to occupy substantially the solid line or the dotted line position shown in FIGURE 6, depending upon which side of the partition 30 the suction hose is to be used. When the suction tube guide is swung outwardly to the solid line position shown in FIGURE 6, its legs 76 rest against respective yieldable abutments or stops 100 carried by side walls 36, 37 of outlet box 26. Yieldable abutments or stops 101 are also carried by side walls 36, 37 for supporting legs 76 of suction tube guide 75 when it occupies the broken line or dotted line position shown in FIGURE 6 in the event that the suction tube is to be withdrawn from the right-hand side of outlet box 26 instead of the left-hand side thereof (FIGURES 3 and 6). Each abutment 100, 101 is shown in the form of a disk or plug mounted on the upper end of a compression spring 102 whose lower end is suitably connected to a small bracket 103 projecting from the corresponding side wall of outlet box 26.

It is apparent that, when suction hose 42 is being withdrawn from suction conduit 21 by an operator, hose 42 is guided upon central roller 92 and between the corresponding pair of side rollers 93, 95 or 94, 96, depending upon the side of the outlet box from which the hose is being withdrawn. In order to reduce or stop the suction in the conduit 21 during such periods as an operator is actually withdrawing suction hose 42 from conduit 21, each collar 77, on the lower ends of the tube guide legs 76, has a switch actuator or cam portion 106 thereon which is adapted to engage and close a corresponding normally open switch 107 whenever the pulling force applied to the suction tube by an operator is sufficient to effect withdrawal of a portion of the suction hose from conduit 21. The strength of corresponding compression springs 102 is such that they will permit suction tube guide 75 to move downwardly sufficiently to cause the corresponding switch actuator 106 to open the corresponding switch 107 only when an outwardly pulling force is being applied to hose 42. Otherwise, both switch actuators 106 will be maintained out of engagement with the corresponding switches 107 even though suction hose 42 may be resting on the roller 92.

It should be noted that the switch actuator 106 on that collar 77 adjacent side wall 36 will operate the corresponding switch 107 therebeneath only when the suction tube guide 75 projects outwardly to the left from outlet box 26, as shown in solid lines in FIGURE 6. The switch actuator 106 on the other of the collars 77 is so positioned as to operate the other of the switches 107 when excess downward pressure is applied to the suction tube guide 75 when it occupies substantially the broken line position shown in FIGURE 6.

Switches 107 are arranged in parallel in an electrical circuit to an electrically operated suction release valve 110 which normally closes an opening 111 in collection box 62. In this instance, suction release valve 110 is shown connected to the plunger of a solenoid 112 (FIGURE 6) fixed by a bracket 113 to the exterior of tank 62. It is apparent that, upon either of the switches 107 being closed by a pulling force being applied to suction hose or tube 42 being pulled in engagement with the roller 92, solenoid 112 will be energized to open valve 110 and permit air from outside tank 62 to enter the same so as to reduce or substantially eliminate suction in suction conduit 21. When the operator relaxes the pulling force on suction hose 42, corresponding abutments 101 elevate the suction tube guide 75 sufficiently to open the corresponding switch 107 so that suction again becomes effective in conduit 21 and suction hose 42.

The amount of suction generally required in a suction cleaning system in order to clean effectively, and such as is produced by suction device 25, applies a small inward pulling force to suction hose 42 and its piston 60 such that the hose may tend to "creep" into conduit 21 when the flow of air into and through suction hose 42 is unrestricted, although such light or small pulling force is insufficient to effectively and quickly retract short sections of suction hose 42, and is completely ineffective to retract the hose in instances where a substantial portion or length of hose 42 may be resting upon the floor, as shown in solid lines in FIGURE 2 and in the dotted line alternative positions 42*a*, 42*b*, 42*c* in FIGURE 2. However, since any inward pulling force on suction hose 42 may be objectionable when hose 42 is substantially completely withdrawn, the outlet end 41 of conduit 21 may be tapered slightly along its length, as at 21*a*, so as to frictionally secure suction hose 42 in substantially fully extended position. Tapered portion 21*a* may be formed separately from and may be attached to conduit 21, if desired, to facilitate installation of the suction cleaning system.

It is apparent that the operator has occasions while manipulating the working end of the suction hose 42 to do so at various distances from the outlet box 26, as shown in FIGURE 2. Heretofore, in order to operate suction hoses conected to outlet boxes of prior art types of central suction cleaning systems, the entire length of the hose necessarily has been fully extended from the corresponding outlet box, with the result that, when the operator was working relatively close to the outlet box of the prior art apparatus, a considerable and excessive length of the suction hose would be resting upon the floor in the form of coils or disarranged configurations which would not only cause the hose to become kinked in some instances, but would also interfere with the efficient manipulation of the working end of the hose by the operator or it might be tripped over by the operator and cause serious injury to the operator.

However, since the valve assembly 44 is provided and located adjacent the working end of the suction hose 42 so as to be conveniently operated by the operator, whenever the operator is working a substantial distance from the receptacle 26 and moves closer and closer to the receptacle 26, the operator need only operate the valve member 47, by means of the pin 53 thereon (FIGURE 5), to periodically restrict the flow of air into the hose 42. Partial or full restriction of the flow of air into the hose 42 substantially increases the pulling force applied to the suction hose by the existing suction in conduit 21 so that the hose 42 may be rapidly and effectively retracted until such time as the operator returns valve member 47 to the fully opened position. Of course, when hose 42 need be only partially retracted the operator may simply constrict the easily deformable tube section 54.

It is thus seen that I have provided a novel method of and apparatus for cleaning wherein the stationary suction conduit 21 is connected to the suction source 25 and the hose 42 is positioned for longitudinal movement within the conduit and also communicates with the suction source so that the desired length of hose may be withdrawn from the conduit 21 for reaching the areas to be cleaned as a suction current produced by the suction source 25 is effective at the working end of the hose for cleaning such area or areas, and wherein, upon completion of cleaning, the flow of the suction current from the hose into the conduit may be sufficiently restricted to effect retraction of the withdrawn length of hose into the conduit under the impetus of the force of suction from the source 25.

In order to prevent flexible hose 42 from being retracted unintentionally into suction conduit 21 when an operator is utilizing the nozzle end of hose 42 for cleaning surfaces, such as draperies, which may be sucked against and restrict the flow of air into hose 42, the nozzle end of hose 42 may be provided with a manually operable relief valve 115 which is shown in the form of a ring segment or substantially C-shaped member fitting in an annular recess 116 formed in a rigid portion of hose 42 adjacent valve assembly 44. Valve 115 may be turned manually about the axis of the nozzle end of hose 42 to partially

or fully expose between opposed ends of valve 115 a suitable opening or slot 117 extending through one side of said rigid portion of hose 42 while draperies or the like are being cleaned.

Thus, if the article being cleaned tends to be sucked against and close the open nozzle end of hose 42 or an implement carried thereby, the operator may open valve 115 to prevent the article from being sucked into hose 42 and to prevent undue restriction of the flow of air into hose 42 so as to prevent suction in conduit 21 from imparting an excessive inward pulling or retracting force to hose 42.

Second embodiment

In the construction heretofore described, suction hose 42 and conduit 21 are arranged so that at least the innermost portion of the suction hose remains within the conduit at all times. Further, in the structure heretofore described, the effectiveness of the suction in the conduit is reduced or eliminated by automatically opening valve 110 (FIGURE 6) whenever an outward pulling force is applied to suction hose 42. In FIGURES 9–13, a modified arrangement is shown in which the suction tube may be entirely removed from the conduit for replacement or for use at other outlet boxes and, in addition, the piston or seal on the inner end of the suction hose is arranged so as to automatically render the suction existing in the conduit substantially ineffective in resisting movement of the suction hose during its withdrawal from the conduit instead of opening a valve at the suction device per se. For purposes of brevity, those parts shown in FIGURES 9–13 which are similar to or identical to corresponding parts shown in FIGURES 1–8 shall bear the same reference characters with the prime notation added.

Outlet box 26', which is shown opening out to one side only of partition 30', may open out to both sides of the partition 30' in the same manner as outlet box 26. Outlet box 26' comprises top, bottom and opposed side walls 34'–37' provided with flanges 40' for securing outlet box 26' to partition 30'. A door 32' is provided for closing the open side of outlet box 26' when it is not being used.

It should be noted that the outlet end 41' of conduit 21' is not tapered in the manner of suction conduit 21 so that, upon releasing a releasable restraining means to be later described, suction hose or tube 42' may be entirely removed and disconnected from suction conduit 21' and outlet box 26'. The piston 60' shown mounted on the inner end of suction hose 42' in FIGURES 9 and 12 is quite different from piston 60 of FIGURES 3 and 6 in that piston 60' is of composite construction and may serve not only as a seal between suction hose 42' and suction conduit 21', but also serves to substantially reduce the pulling force or retracting force of the suction in conduit 21' during such times that the operator is pulling and withdrawing suction hose 42' from conduit 21'.

To this end, composite piston 60' comprises a pair of relatively displaceable rings or annular members 120, 121, the annular member 120 being fixed on the inner end of suction hose 42' and serving as a suction release member, and the annular member 121 being mounted for movement relative to suction release member 120 and serving as a valve.

The inner diameter of annular valve 121 is preferably substantially the same as that of suction tube 42'. The outer diameter of valve 121 is preferably such that it will move in substantially sealing engagement with the inner surface of suction conduit 21'. Preferably, but not necessarily, the outer diameter of suction release member 120 is slightly less than that of valve 121 so that the two normally juxtaposed annnular members 120, 121 will separate automatically when an outward pulling force is being applied to suction hose 42' by an operator.

Annular members 120, 121 of composite piston 60' are interconnected for relative axial displacement by means of a plurality of circularly spaced guide rods or pins 123 which may be secured in annular member 120 and loosely penetrate annular member 121. In order to yieldably urge and normally maintain valve 121 in sealing engagement with suction release member 120, the inner ends of guide rods 123 project beyond the inner surface of valve 121 and head portions 124 thereon maintain compression springs 125 surrounding the inner ends of guide rods 123 in engagement with the inner surface of valve 121. Thus, compression springs 125 normally urge valve 121 into engagement with the inner end of suction release member 120. In so doing, valve 121 closes a plurality of circularly arranged ports or passageways 126 extending through, and substantially parallel to the axis of, suction release member 120.

Whenever an operator applies an outward pulling force to and withdraws hose 42' from conduit 21', the frictional contact between valve 121 and conduit 21' overcomes the force of springs 124 so the suction release member 120 will be pulled away from valve 121 to the extent permitted by the compression springs 124 until the operator relaxes or discontinues the withdrawing pulling force on suction hose 42'. Since the outlet end 41' of suction conduit 21' is substantially open at all times other than that in which piston 60' may be located at the outlet end 41' of suction conduit 21', it follows that the movement of suction release member 120 away from vlave 121 permits air to flow into the outlet end 41' of suction conduit 21', and through the passageways 126 in suction release member 120, thus reducing the effectiveness of the suction produced at the source in acting upon the piston 60' and suction hose 42', so the suction hose 42' may be easily withdrawn from suction conduit 21' by the operator. When the operator has withdrawn the desired length of suction hose 42' from suction conduit 21', the outward pulling force thus released from the suction hose 42' permits springs 125 to move valve 121 into engagement with the inner end of suction release member 120 to close passageways 126 so the suction source is fully effective in the suction hose 42' during the subsequent cleaning operation.

When suction hose 42' is substantially fully withdrawn from suction conduit 21', with the piston 60' positioned at the outlet portion of suction conduit 21' as shown in FIGURE 9, the pulling force of the suction acting upon the inner end of suction hose 42' and piston 60' may be reduced by providing small perforations or air inlet openings 130 in and closely adjacent the outlet end of suction conduit 21' inwardly of piston 60'. These perforations 130 should be of such size as to reduce the effectiveness of the suction in the conduit 21' sufficiently only to render such suction ineffective in applying any objectionable inward pulling force to hose 42' while still maintaining adequate suction to carry out the desired cleaning function.

In order that the operator will not inadvertently withdraw the hose 42' with its composite piston 60' entirely out of the suction conduit 21', means are provided for releasably restraining the piston 60' from being withdrawn from the outlet end 41' of suction conduit 21'. Such restraining means comprises a latch member 132 (FIGURES 9 and 11) slidably mounted upon the bottom wall 35' of outlet box 26'. Opposed side edge portions of latch member 132 are guided and maintained in engagement with bottom wall 35' by a pair of spaced gibs 133 which may be substantially L-shaped in cross-section and may be secured to bottom wall 35' of outlet box 26' by any suitable means, such as welding.

Latch member 132 is substantially U-shaped in plan and its inner portion remote from the open side of outlet box 26' may be engaged by a compression spring 134 which bears against the back wall 135 of outlet box 26' to normally urge the back portion of latch member 132 into position overlying the open upper end of suction conduit 21'. The two legs of the substantially U-shaped latch member 132 is turned upwardly, as at 136, so they may be engaged and pushed inwardly by an operator

when the operator wishes to move the latch member **132** for releasing the piston **60'** from the open upper end **41'** of the suction conduit **21'**.

The spring biased push-button **71'** on the switch **70'** in the embodiment of FIGURES 9 and 10 is positioned so as to be engaged and depressed by the door **32'** when it is moved to closed position. Switch **70'** may be connected to the suction source in the same manner as switches **70** heretofore described and thus renders the suction source inoperative whenever door **32'** is closed.

Although the composite piston **60'** heretofore described reduces the effectiveness of suction in suction conduit **21'** acting upon the suction hose **42'** and the piston **60'** when suction hose **42'** is being withdrawn from suction conduit **21'**, additional means may be provided for reducing or eliminating suction in conduit **21'** during withdrawal of substantial lengths of the hose **42'** from suction conduit **21'**. Such means may be identical to the suction tube guide **75** heretofore described (FIGURES 3, 4, 6, 7 and 8) but is shown in modified form in FIGURES 9 and 10 wherein it will be observed that a substantially horizontal roller **140** is journaled in vertically slotted bearings **141** adjacent opposed side walls **36'**, **37'** of outlet box **26'**.

Bearings **141** have respective compression springs **142** therein which normally urge roller **140** upwardly and which springs are of such strength as to normally maintain roller **140** in its upward position shown in FIGURE 10 whenever suction hose **42'** is resting thereupon under its own weight and an outward pulling force is not being applied thereto by the operator. When an outward pulling force is applied to suction hose **42'** by an operator, roller **140** is moved downwardly in opposition to springs **142** to engage and close a normally open switch **145** which may function in the same manner as the switches **107** of FIGURES 6, 7 and 8 for permitting outside air to enter the suction tank, as described with reference to the lower right-hand portion of FIGURE 6.

Switch **145** may be conveniently positioned between the legs of the substantially U-shaped latch member **132** and suitably secured to the bottom wall **35'** of outlet box **26'**.

The side walls **36'**, **37'** of outlet box **26'** may also have suitable upright rollers **147**, **148** journaled thereon to assist in guiding the suction hose **42'** when it is being manually withdrawn from the suction conduit **21'** at an acute angle with respect to the face of the wall **30'** to which flanges **40'** of outlet box **26'** are secured. Of course, the rolls **140**, **147**, **148** also cooperate in guiding suction hose **42'** during its retraction into suction conduit **21'**, which retraction may be effected in the same manner as that in which it is effected with respect to the suction hose **42** as heretofore described.

It should be noted that, in both forms of the invention, when the suction tube is being retracted into the corresponding suction conduit, the hose is moving away from the corresponding bottom roller **92** or **140'**, as the case may be, so the tube will not cause the corresponding switches **77** or switch **145** to stop or reduce the effectiveness of the suction in the suction conduit **21** during retraction of the suction hose **42**.

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 cleaning utilizing a suction cleaner having a conduit communicatively connected to a suction source and an elongate pliable hose positioned for longitudinal movement within the conduit and also communicating with the suction source, said method comprising the steps of withdrawing any desired length of the hose from the conduit for reaching any area to be cleaned,

conducting a suction current through the conduit and hose, applying a suction current through the medium of the hose to the area to be cleaned, and upon completion of cleaning, effecting retraction of the withdrawn length of hose into the conduit under the impetus of the force of the suction from said source by restricting the flow of the suction current from the hose into the conduit.

2. A method of cleaning surfaces utilizing a suction cleaning system having a fixed suction conduit with one of its ends communicating with a source of suction, and having a mouth at its other end, and an elongate flexible suction hose extending longitudinally and sealingly within the conduit and being open at both ends, said method comprising the steps of

withdrawing a variable desired length of said hose from the conduit through its mouth,

utilizing the outer end of the withdrawn hose for performing a cleaning function as fluid is sucked into the hose, and upon completion of cleaning

retracting the hose into the conduit by restricting the flow of fluid through said hose to a sufficient extent to so increase the effective pulling force exerted on the hose by the source of suction such as to pull the hose into the conduit.

3. A method of cleaning utilizing an elongate conduit having an open mouth at one end and fluid flow inducing means at its other end effecting flow of fluid toward the flow inducing means, and an elongate pliable hose telescopically mounted in said conduit and in substantially sealing engagement with said conduit so said fluid flow tends to pull the hose into the conduit, said method comprising

withdrawing a variable substantial length of the hose from the conduit through its mouth,

frictionally restraining the hose from being retracted into the conduit while said length is withdrawn,

applying a suction current through the medium of the hose to the area to be cleaned, and upon completion of cleaning,

retracting the hose into the conduit by increasing the effective pulling force exerted on the hose by the fluid flow inducing means sufficiently to overcome the force frictionally restraining retraction of the hose and thereby pulling the hose into the conduit.

4. In a cleaning system utilizing an elongate conduit having an open mouth at one end and fluid flow inducing means at its other end effecting flow of fluid toward the flow inducing means, an elongate flexible hose telescopically mounted in said conduit, and sealing means on and movable with said hose in substantially sealing engagement with said conduit so said fluid flow tends to pull the hose into the conduit, a method of controlling the hose which comprises

withdrawing a variable desired length of the hose from the conduit through its mouth,

frictionally locking the sealing means in engagement with said conduit while said hose is withdrawn and being used for cleaning, and thereafter

upon completion of cleaning, retracting the hose into the conduit by increasing the effective pulling force exerted on the sealing means by the fluid flow inducing means sufficiently to overcome the force frictionally locking the sealing means in engagement with said conduit and thereby pulling the hose into the conduit.

5. A method of cleaning utilizing an elongate conduit having an open mouth at one end and fluid flow inducing means at its other end effecting flow of fluid toward the flow inducing means, and an elongate flexible hose telescopically mounted in and in substantially sealing engagement with said conduit so said fluid flow tends normally to pull the hose into the conduit, said method comprising

withdrawing a variable substantial length of the hose from the conduit through its mouth while reducing the effective pulling force exerted on said hose by the fluid flow inducing means, thereafter

restoring to normal the pulling force exerted on the hose by the fluid flow inducing means while applying a suction current through the medium of the hose to an area to be cleaned, and upon completion of cleaning,

retracting the hose into the conduit by increasing the effective pulling force exerted on the hose by the fluid flow inducing means substantially above said normal pulling force such as to effectively pull the hose into the conduit.

6. A method of cleaning utilizing a suction cleaner having a stationary conduit communicatively connected to a suction source and an elongate pliable hose positioned for longitudinal movement within the conduit and also communicating with the suction source, said method comprising the steps of applying an outward pulling force to and withdrawing a variable desired length of the hose from the conduit for reaching any area to be cleaned while substantially reducing the effectiveness of the force of the suction current from said source acting on the hose in response to the outward pulling force, automatically restoring to normal the effectiveness of the force of the suction current from said source upon termination of application of said outward pulling force while conducting the suction current from the source through the conduit and hose, applying the suction current through the medium of the hose to the area to be cleaned, and upon completion of cleaning, retracting the hose into the conduit by utilizing the suction current from said source to pull the withdrawn length of hose into the conduit.

7. A suction cleaning system comprising a conduit communicatively connected to a suction source, an elongate pliable hose positioned for longitudinal movement within the conduit and also communicating with the suction source and arranged to have a variable desired length withdrawn from the conduit for extending to the area to be cleaned, and means to effect retraction of the withdrawn length of hose into the conduit under the impetus of the force of the suction from said source, said means including means adjacent the extended end of the hose for interruptedly restricting the flow of fluid from the hose into the conduit.

8. In a suction cleaning system; the combination of an elongate suction conduit having an open mouth at one end and having its other end connected to a source of suction, an elongate flexible suction hose open at both ends and positioned for longitudinal movement loosely within the conduit and arranged to have a variable desired length withdrawn from the conduit for extending to the area to be cleaned, the inner end of said hose providing a pressure area such that a relatively light back pulling force normally is exerted on said hose by the suction such that an operator may easily withdraw said hose from said conduit, and means to effect pulling retraction of the withdrawn length of hose into said conduit under the impetus of the force of the suction from said source comprising means adjacent the extended end of the hose for reducing the air flow through said hose into said conduit.

9. In a suction cleaning system including an elongate suction conduit having an open mouth at one end and having its other end connected to a source of suction; the combination therewith of

an elongate flexible suction hose open at both ends and positioned for longitudinal movement loosely within the conduit and arranged to have a variable desired length withdrawn from the conduit for extending to the area to be cleaned,

sealing means movable with said hose in substantially sealing engagement with said conduit and providing a pressure area such that a relatively light back pulling force normally is exerted on said hose by the suction such that an operator may easily withdraw said hose from said conduit, and

means located adjacent the outer end of the hose for effecting retraction of the withdrawn length of hose under the impetus of the force of the suction from the source comprising valve means for reducing the flow of air through said hose to thereby increase the effectiveness of said suction in applying the back pulling force on said hose such as to pull said hose into said conduit.

10. A structure according to claim 9 including means operatively associated with said suction hose and being responsive to withdrawing movement of said hose relative to said conduit for reducing the back pulling force normally exerted on said hose by the suction.

11. A structure according to claim 9 wherein said sealing means comprises a piston carried by the inner end of said hose.

12. A structure according to claim 11 wherein said piston comprises a first annular member fixed with respect to said hose, a second annular member axially of said first member, means normally yieldably urging said second member against the inner end of said first member, one of said members having at least one passageway therethrough which is closed when said second member is against said first member, and said first member being movable away from said second member due to frictional engagement of the second member with said conduit whenever said hose is being withdrawn from said conduit to open said passageway to the passage of fluid therethrough.

13. A cleaning system comprising an elongate conduit having an open mouth at one end, fluid flow inducing means connected to the other end of the conduit for effecting flow of fluid therethrough toward the flow inducing means, a flexible suction hose telescopically mounted in and in substantially sealing engagement with said conduit so said fluid flow tends normally to pull the hose into the conduit, said hose being arranged to be manually withdrawn from said conduit, and means operatively associated with said hose and responsive to and during withdrawal of a length of the hose from the conduit through its mouth for reducing the effective pulling force exerted on said hose by the fluid flow inducing means and being operable to restore to normal the pulling force exerted on the hose by the fluid flow inducing means upon termination of withdrawal of the length of the hose from the conduit whereby said flow inducing means then will be fully effective in effecting flow of fluid into and through the hose and the conduit.

14. A cleaning system according to claim 13 wherein said means for reducing the effective pulling force exerted on said hose by the fluid flow inducing means comprises a normally closed valve operatively associated with said fluid flow inducing means for reducing the flow of fluid effected in said conduit by the fluid flow inducing means when said valve is open, a member adjacent the open mouth of said conduit adapted to be engaged by said suction hose and being operatively connected to said valve, and said member adjacent the mouth of the conduit being responsive to the application of a predetermined force thereagainst in excess of the normal pressure of engagement of the hose therewith, as effected by pulling the hose to withdraw the same relative to the conduit, for opening said valve.

15. A cleaning system according to claim 13 wherein said means operatively associated with said hose for reducing the effective pulling force exerted thereon comprises a first annular member fixed in axial relationship to said hose and being of greater external diameter than said hose and having at least one passageway therethrough located adjacent the outer surface of said hose, a second annular member axially inwardly of said first member, means normally biasing said second member against the inner end of said first member whereby said second member normally closes said passageway, means limiting the extent of movement of said second member away from

said first member, said second member being arranged to frictionally engage said conduit whenever said hose and said first member are being withdrawn from said conduit whereby said first member moves away from said second member and said passageway is open to the passage of fluid therethrough from the mouth of the conduit to reduce the effective pulling force exerted on said hose by the fluid flow inducing means and, upon termination of withdrawal of the hose from the conduit with the annular member still within the conduit, said biasing means will return said second member to a position against said first member.

16. A cleaning system comprising an elongate conduit having an open mouth at one end, fluid flow inducing means connected to the other end of the conduit for effecting flow of fluid therethrough toward the flow inducing means, a suction hose telescopically mounted in and in substantially sealing engagement with said conduit so said fluid flow tends normally to pull the hose into the conduit, said hose being arranged to be manually withdrawn from said conduit, means operatively associated with said hose and responsive to and during withdrawal of a length of the hose from the conduit through its mouth for reducing the effective pulling force exerted on said hose by the fluid flow inducing means and being operable to restore to normal the pulling force exerted on the hose by the fluid flow inducing means upon termination of withdrawal of the length of the hose from the conduit whereby said flow inducing means then will be fully effective in effecting flow of fluid into and through the hose and the conduit, and means for increasing the effective pulling force exerted on the hose by the fluid flow inducing means substantially above said normal pulling force such as to effectively retract the hose into the conduit.

17. A cleaning system as claimed in claim **16** wherein said means for increasing the effective pulling force exerted on the hose by the fluid flow inducing means comprises manually operable means operatively associated with and located adjacent the outer end of said suction hose for restricting the flow of fluid through said hose.

18. A cleaning system as claimed in claim **16** wherein said means for increasing the effective pulling force exerted on the hose by the fluid flow inducing means comprises a manually operable valve member adjacent the working

end of said hose and being operable to restrict the flow of fluid into said hose.

19. A cleaning system as claimed in claim **16** wherein said means for increasing the pulling force exerted on the hose by the fluid flow inducing means comprises a hose section interposed in said suction hose adjacent its working end and being of a yieldable material relative to the material of which the suction hose is formed and being capable of being constricted manually to thereby restrict the flow of fluid into said suction hose.

20. A cleaning system for use in a building having a wall, said system comprising an outlet box opening to at least one side of the wall, an elongate conduit having a portion within said wall and having an open mouth at one end communicating with said outlet box, a suction device located a substantial distance from said outlet box and connected to the other end of said conduit, a flexible suction hose telescopically mounted in said conduit whereby a suction current from said suction device normally tends to pull the hose into the conduit, said hose having a working end adapted to be positioned within said outlet box when said hose is fully positioned in said conduit, said hose being arranged to be manually withdrawn from said conduit and through the open side of said outlet box, means operatively associated with said hose and responsive to and during withdrawal of a length of the hose from the conduit through its mouth for reducing the effective pulling force exerted on said hose by the suction device and being operable to restore to normal the pulling force exerted on said hose by the suction device upon termination of withdrawal of said length of said hose from said conduit whereby said suction device then will be fully effective in effecting flow to fluid into and through said hose and said conduit.

References Cited

UNITED STATES PATENTS

1,455,116	5/1923	Lumley	15—314 X
2,953,806	9/1960	Walker	15—315
3,027,588	4/1962	Bierstock	15—301

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