G. J. & A. W. KINDEL.

PNEUMATIC CLEANING SYSTEM.

APPLICATION FILED FEB. 13, 1909.

950,722.

Patented Mar. 1, 1910.

3 SHEETS—SHEET 1.

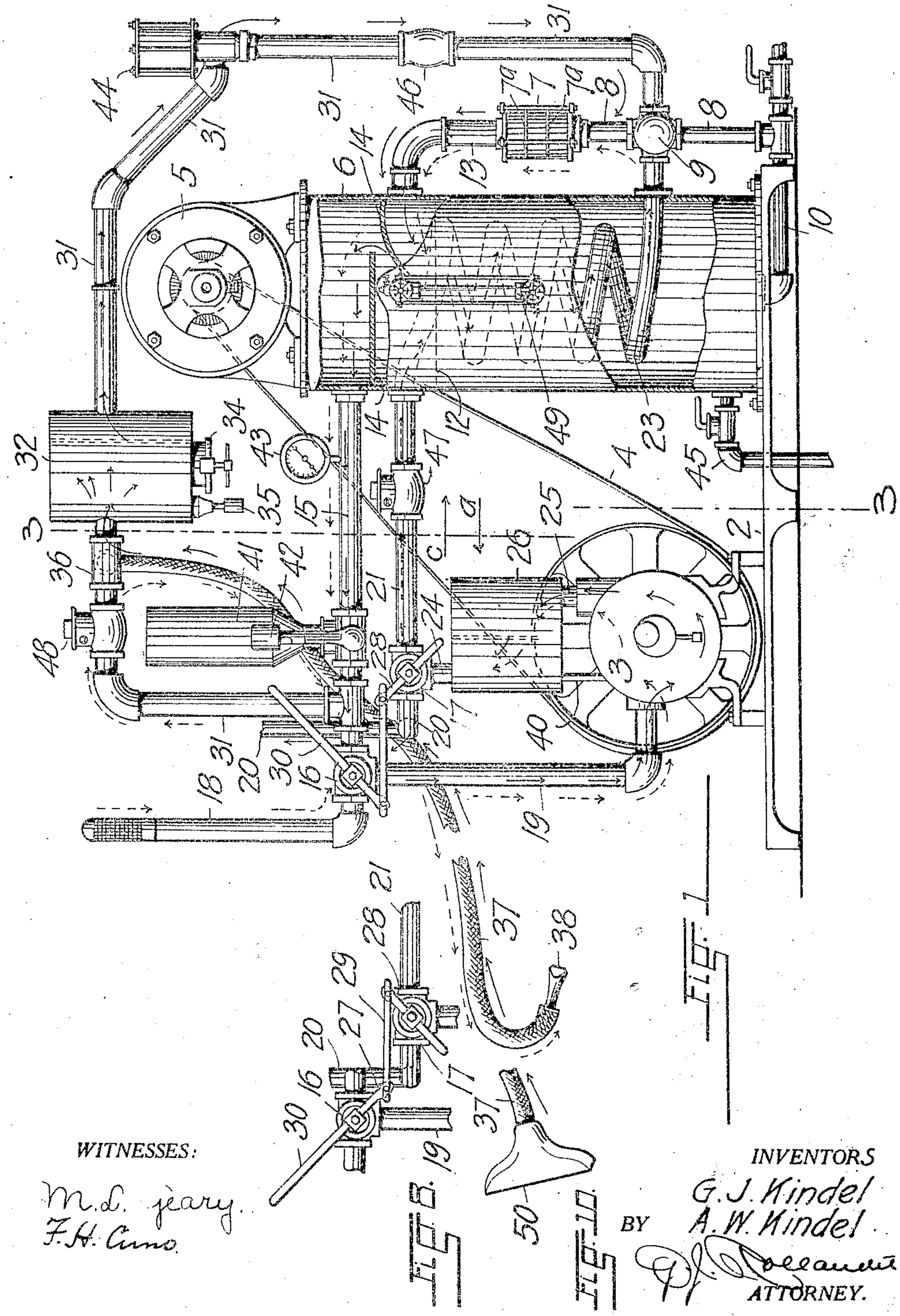

FIG. 1

FIG. 8.

FIG. 10.

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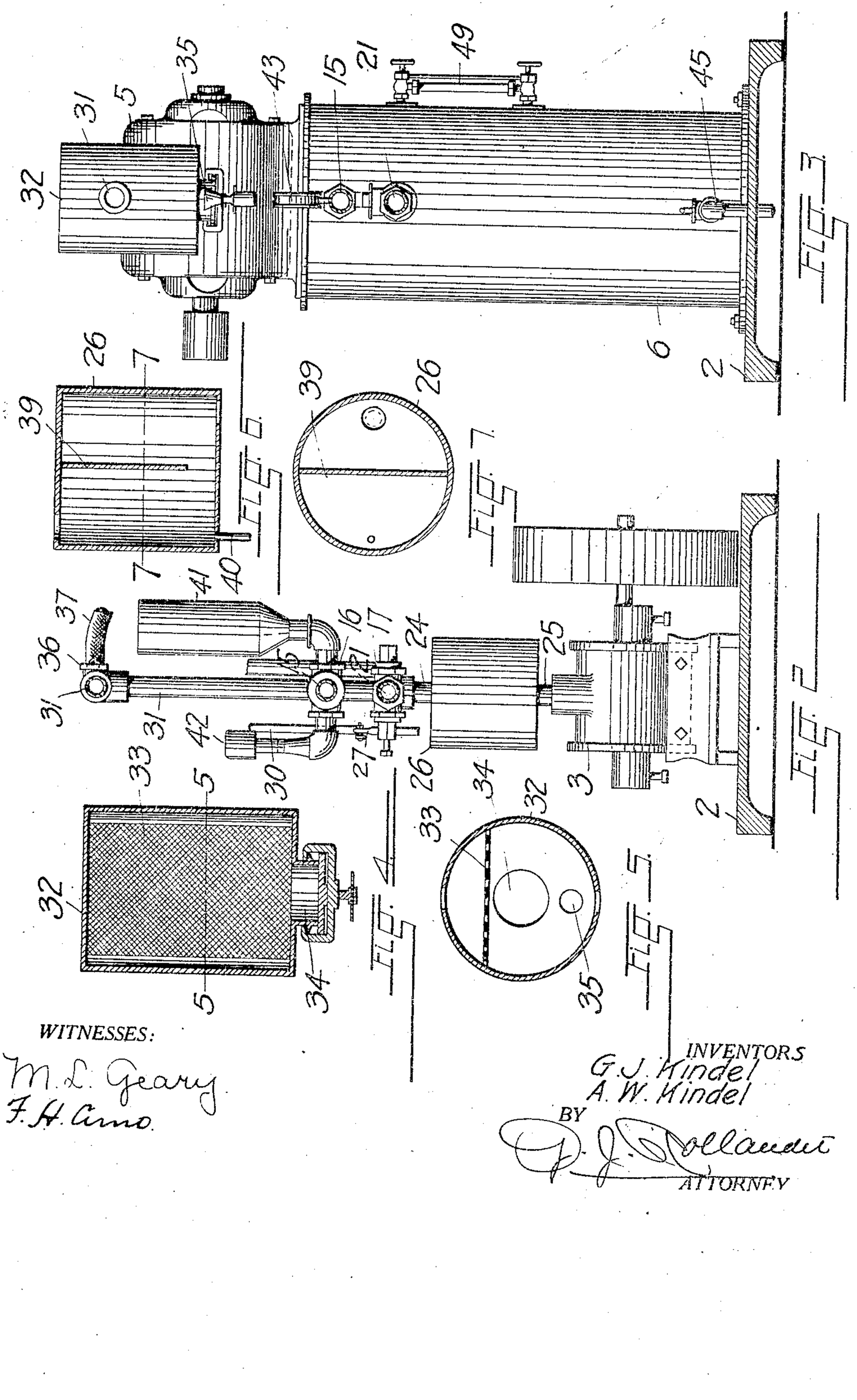

FIG. 3

FIG. 1

FIG. 2

FIG. 4

FIG. 5

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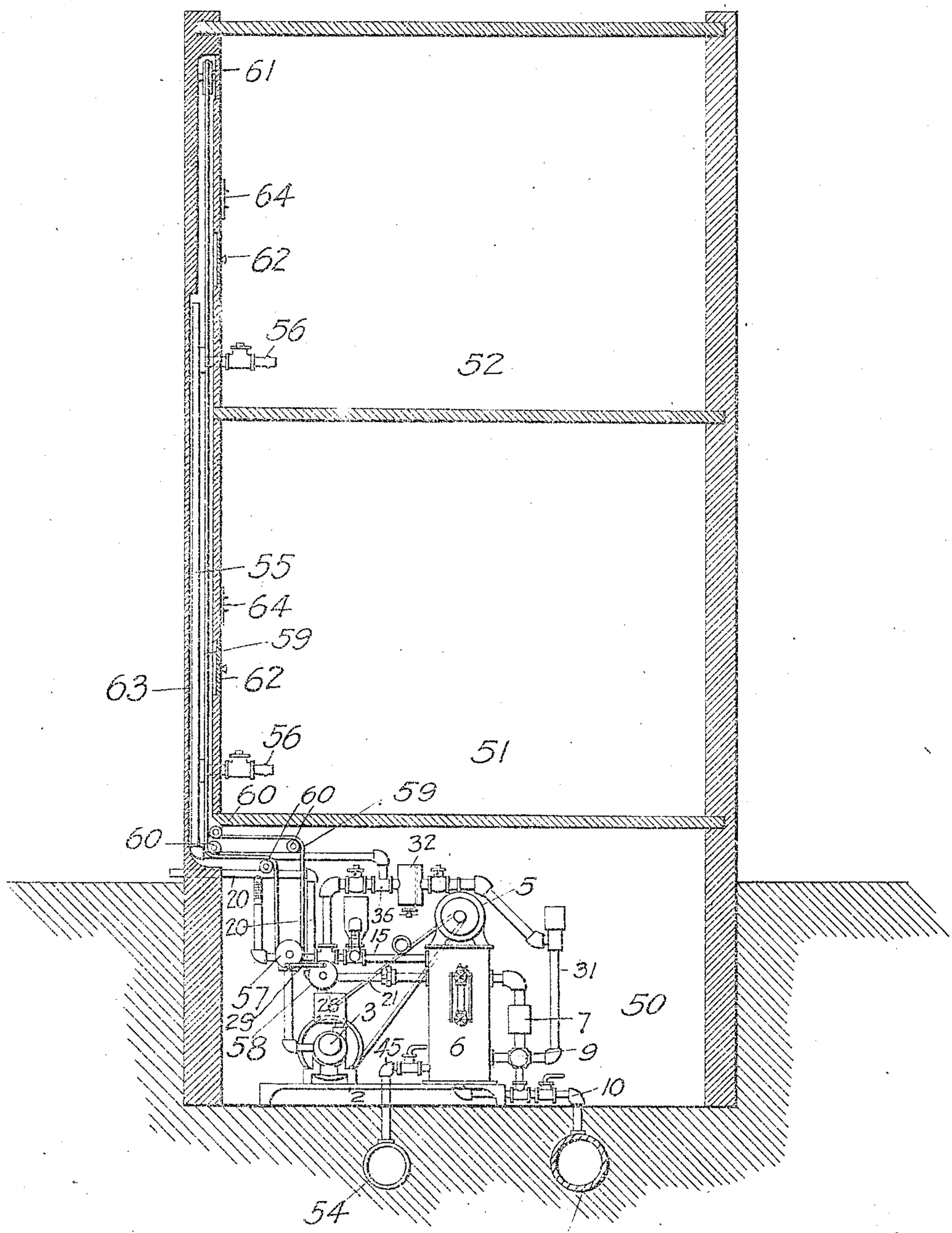

FIG. 3.

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PNEUMATIC CLEANING SYSTEM.

950,722. Specification of Letters Patent. Patented Mar. 1, 1910.

Application filed February 13, 1909. Serial No. 477,590.

To all whom it may concern:

Be it known that we, GEORGE J. KINDEL and ARTHUR W. KINDEL, citizens of the United States of America, residing at Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Pneumatic Cleaning Systems, of which the following is a specification.

This invention relates to certain new and useful improvements in air cleaning systems and its principal object resides in the provision of a system of coöperatively connected elements which may be employed in the process of cleaning by the production of a vacuum as well as in that in which the dirt is removed by the expulsion of air under compression, without the necessity of stopping or reversing the motor included in the said system or without, in any manner, changing the relative positions or interconnections of the associated elements.

Further objects of the invention, relating to the purification of the air exhausted by action of the pump and the separation therefrom of all extraneous solid or fluid substances carried thereby, will be fully brought out in the following description, reference being had to the accompanying drawings in the various views of which like parts are similarly designated and in which,

Figure 1, represents a side elevation of the entire system, Fig. 2, a cross-sectional view taken along the line 3—3 Fig. 1, looking in the direction of the arrow *a*, Fig. 3, a similar view taken along the same line, looking in the direction of the arrow *c*, Fig. 4, a sectional view of the arrester in which the larger substances carried by the air, are separated therefrom, Fig. 5, a section taken along the line 5—5 Fig. 4, Fig. 6, a vertical section through the oil-separator included in the system, Fig. 7, a transverse section taken along the line 7—7 Fig. 6, Fig. 8, a fragmentary view of the pipe connections of the system, showing the coöperative controller-valves in the reversed position relative to that shown in Fig. 1, Fig. 9, a vertical, sectional elevation of a two story building showing the improved air cleaning system in operative position together with means whereby the controller-valves may be reversed from any selected elevation, and the stand-pipe which enables the operator to attach the nozzled hose, through which the dirt is removed from the surface to be cleaned, at any one of the floors of the building, and Fig. 10, a view of the nozzle used in the vacuum process.

Referring to the drawings by numerals, let 2 designate a base upon which the various elements comprised in the improved system, are mounted.

The numeral 3 denotes a rotary air pump which may be of any suitable construction, and which serves to either produce a vacuum or condense the air during the operation of the apparatus with which it is associated. The pump 3 is operatively connected by means of a continuous belt 4, with a motor 5 which is connected with a convenient source of energy (in this instance electricity), and this motor is preferably mounted upon an upright cylindrical tank 6 which constitutes the water reservoir in which the dirt, separated from the air, is collected and assimilates with the fluid.

The separation of the impurities from the air is effected through the instrumentality of a cleansing device 7 in which the air is thoroughly intermixed with the water contained in the reservoir, and which, to this end, consists of a cylindrical vessel, preferably composed of transparent material and provided with one or more perforated, transverse partitions 7^a through which the water and the dust-laden air pass during their circulatory movement to and from the reservoir 6. The cleansing device 7, whose construction and operation are fully described in United States Patent, #837,536, of July 31, 1906, is connected by means of downwardly extending pipes 8 and a therewith connected cross 9, with the valve controlled outlet pipe 10 which connects with the bottom of the reservoir for the purpose of removing its contents, and the said device communicates furthermore, with the upper portion of the reservoir, above the water level (which in the drawings is indicated by the line 12), by means of a conduit 13. Two dash-boards 14 are arranged in lapping relation, within the reservoir above the orifice of the conduit 13, for the purpose of preventing the continually agitated water from entering the outlet pipe 15 which opens into the reservoir above the upper dash-board and through which the purified air is conducted to the point of exhaust. The pipe 15 connects at its outer end with the housing of a three-way valve 16 which, in coöperation with a second valve 17 of similar construc-

tion, controls the flow of air through the system and thereby adapts the latter for use in either one of the processes of cleaning by means of a vacuum and by compressed air as will hereinafter be fully explained. The housing of the valve 16 connects furthermore, with a screen-covered air-intake 18 and with a conduit 19 which leads to the ingress-opening of the pump and the said valve is so arranged, in relation to its ports, that, when placed in the position shown in Fig. 1, it connects the intake 18 with the conduit 19 and stops the communication between the latter and the pipe 15, while, in its reversed position, shown in Fig. 8, it closes the communication between the intake 18 and the pipe 19 and connects the latter with the pipe 15. The housing of the three-way valve 17 connects with the exhaust-pipe 20, with the egress opening of the pump, and with the air-cleansing device 7, by means of a conduit 21 which terminates in a coil 23 which is disposed in the reservoir 6 and whose opposite extremity connects with the before mentioned cross 9. The communication between the valve 17 and the egress opening of the pump 3 is established by means of two short conduits 24 and 25 and an interposed oil-separator 26, the construction of which will hereinafter be described. The valves 16 and 17 are connected to move in unison and are, to this end provided with crank arms 27 and 28 which are connected by means of a link 29. A handle 30 formed by an extension of the crank arm 27, serves in the operation of the apparatus, to reverse the position of the two valves, which may be accomplished manually or by mechanical or electrical means as will hereinafter be described. The valve 17 is arranged relative to its ports, so as to connect the egress opening of the pump with the conduit 21 and to close communication with the exhaust pipe 20, when in the position shown in Fig. 1, while it connects the latter with the pump 3 and interrupts the communication between the said pump and the conduit 21 when in the reversed position, illustrated in Fig. 8.

The outlet conduit 15 connects, at a point between the valve 16 and the reservoir 6, with a branch-pipe 31 which communicates with the air-cleansing device 7 by connection with the cross 9 and which is broken for the placing, between its extremities, of a separator 32 which serves to arrest particles larger than those ordinarily comprised in dust, such as cigar stumps, nails, buttons etc., which were drawn into the nozzle of the apparatus while removing dirt by the vacuum or suction process. The separator 32 consists, to the above end, of a cylindrical casing provided with a vertically disposed foraminous partition 33 which divides its interior into two compartments with which the two portions of the broken conduit 31, are respectively connected. The larger of the two compartments which communicates with the portion of the conduit 31 connecting with the outlet pipe 15, has in its bottom a normally covered outlet 34 through which the matter arrested by the partition 33, may be removed and the said compartment is furthermore provided with a safety-valve 35 for the automatic inlet of air in case the vacuum within the separator exceeds a predetermined degree. The valve 35 is also of use in automatically separating the fine dust from the larger particles collected in the separator 32 and in impelling the former to and through the cleansing device 7, by admitting air into the separator after the operation of the system has been discontinued. The conduit 31, has, at a point in between its connections with the conduit 15 and the separator 32, an orifice which serves as an outlet or an inlet for the air, flowing from or into the system and this orifice is preferably provided, by means of a T 36, which connects with the flexible conduit 37 at whose outer extremity a nozzle is attached which, during the operation of the apparatus, is held in contact with the carpet or other surface to be cleaned.

When the apparatus is operated to produce a blast of air the nozzle is preferably composed of a short tubular body formed with a narrow rectilinear orifice, as is shown at 38 in Fig. 1, while, when the system is employed to remove dust by the vacuum process, a nozzle 50, such as is shown in Fig. 10 of the drawings, is substituted for the other.

The nozzle 38 has been made the subject of a separate application for patent filed simultaneously with the present one, while the vacuum nozzle 50 is fully described in the United States Patent, Number 890,987, issued June 16, 1908, to Arthur W. Kindel, one of the applicants in the present application.

The hereinbefore mentioned oil-separator 26, shown in detail in Figs. 6 and 7, serves to separate the greater part of the oil from the air with which it became associated during the latter's course through the pump 3. It consists of a cylindrical receptacle provided with a vertical partition 39 which extends downwardly from its top and terminates a short distance above its bottom, the conduits 24 and 25 being disposed at opposite sides thereof. The oil-laden air entering the receptacle through the connection 25, fills the respective compartments whence it flows underneath the partition 39 into the adjacent compartment and thence through the connection 24, to the exhaust pipe 20 or to the cleansing device 7 as the case may be. The oil which is separated from the air by its specific gravity and by frictional contact with the lower edge of

the partition, drops to the bottom of the receptacle 26 from where it returns to the pump 3 through a small pipe 40. The pipe 15 through which the air is conducted from the reservoir 6, to either the nozzle 38 or the pump 3, is connected with an air chamber 41 for the purpose of equalizing the flow of liquid, with a safety-valve 42 for the outlet of air, should the pressure within the conduit exceed a predetermined degree, and with a pressure gage 43 adapted to indicate the degree of air pressure or vacuum during the operation of the system.

A glass vessel 44 connected with the conduit 31 at a point intermediate the cleansing device 7 and the separator 32, enables the operator to observe the : ion of the air while the system is in operation during the vacuum process, and a valve controlled conduit 45 is connected with the lower portion of the reservoir for the purpose of replenishing the latter with clear water after the foul water has been exhausted through the pipe 10. The pipe connections included in the system are furthermore provided with three check-valves one of which, designated by the numeral 46, is located in the conduit 31 in proximity to the cross 9 and serves to prevent the air which flows from the coil 23 into the cross 9, from passing upwardly through the conduit 31, when the system is operated to produce a forcible current of air.

The object of the second check valve 47 located in the pipe 21, intermediate the reservoir 6 and the valve 17, is to prevent an influx of air and water into the pump while the system is operated to produce a vacuum, while that of the third valve 48 is to prevent the air from flowing to the pump in unfiltered condition, under the same circumstances. A water-gage 49 is connected with the reservoir 6, to indicate the height of the water-surface therein.

The building illustrated in Fig. 9 of the drawings has a basement 50 in which the above described air-cleaning system is installed, and two stories 51 and 52. The water-outlet pipe of the reservoir 6 of the system, which latter has been drawn to an exaggerated scale relative to the building, connects with the sewer 53, and the inlet pipe 45 of the said reservoir may connect with the water main 54 as shown, or it may extend upwardly to any other source of water supply.

The T 36 to which, in the construction shown in Fig. 1, the flexible conduit 37 is attached, connects, when the apparatus is installed in a building, with a standpipe 55, and this standpipe, which extends through a wall of the building, is provided on each floor, with a valve-controlled nipple 56 to which the hose 37 may be attached.

The controller valves 16 and 17 are provided with crank-wheels 57 and 58 in place of the crank-arms 27 and 28 shown in Fig. 1, and the wheel 57, connected with the valve 16, has a peripheral groove for the reception of a continuous rope or chain 59 which extends over guide pulleys 60, to a recess 63 in a wall of the building in which it extends vertically and over a sheave 61 which is rotatably mounted in the recess near the top of the building. By pulling the rope 59 up or downwardly, which may be accomplished through doors 62 which afford access to the recess at each floor, the position of the two valves may be reversed to operate the system for the production of either a vacuum or a forcible current of air.

It will be understood that the wires which connect the motor 5 with the source of electricity, may be led through the recess 63 in the wall, in which case a switch 64 at each floor enables the operator to start or discontinue the action of the pump 3. The exhaust pipe 20 has been shown to project and terminate outside the building.

Having thus described the mechanical construction of the various elements comprised in our improved system as well as the method of connecting them, we will now proceed to explain the operation of the apparatus in producing the two results of which it is capable.

Presuming that the position of the controller-valves 16 and 17, as shown in Fig. 1 of the drawings, adapts the system to remove dust from the surface engaged by the nozzles 38, by means of a blast of air emitted therethrough, it will be observed that, in accordance with the preceding description, the intake 18 is in communication with the ingress pipe 19 of the pump 3 and the exhaust 20 is disconnected from the conduit 21 which communicates with the egress opening of the pump.

The course of the air through the various elements and connections included in the system, during the process of cleaning by the ejection of air through the nozzle, is indicated by broken-line arrows (– – – –>) while the direction of the air drawn into the nozzle during the vacuum process, is denoted by means of solid-line arrows (————>).

The pump 3, having been put in motion through the instrumentality of the motor 5, draws the air into the intake 18, through the conduit 19 and ejects it through the connection 25 into the receptacle 26, in which the greater portion of the lubricating oil which was carried by the air from the motor, is separated from the former to return to the motor through the pipe 40. The air flows from the separator through the connection 24 into the conduit 21 and through the coil 23 where it is cooled by the influence of the surrounding water, with the result that the oil carried by the air in vaporized condition,

condenses. The air now enters the cleansing device through the cross 9 (the check valve 46 preventing its passing through the conduit 31) and, while driving the water contained therein, upwardly through the pipe 13, into the reservoir, thoroughly intermixes with the liquid with the result that the oil, as well as all other impurities, are separated from the air, which subsequently is discharged from the reservoir in a purified condition, through the outlet conduit 15, to the conduit 31 and thence through the flexible conduit 37 to the air-nozzle 38 from which it is forcibly ejected to dislodge dust and dirt from the surface in whose proximity the latter is held.

It will be observed that the water displaced by the air entering the cleansing device 7, is at once replaced by a similar quantity passing from the reservoir through the pipes 10 and 8, so that during the operation of the apparatus, there is a constant circulatory movement of the water through the device 7 and the reservoir 6. The dirt and dust separated from the air, settles upon the bottom of the reservoir while the oil remains supernatant upon the surface of the water and, when the quantity of matter separated from the air, is sufficiently great to render the water unfit for further use, it is discharged with the latter by simultaneous opening of the valves in the water inlet 45 and the outlet 10. After all the impure matter is discharged, the tank 6 is refilled by closing the valve in the outlet pipe.

To adapt the system for use in the vacuum cleaning process, the valves 16 and 17 are reversed to the position shown in Fig. 8 with the result that the communication between the intake 18 and the other parts of the system is interrupted, the ingress pipe 19 of the pump is connected with the outlet pipe 15 of the reservoir, the exhaust pipe 20 is brought in communication with the egress opening of the pump through the oil separator 26 and the connections 24 and 25, and the connection between the latter and the pipe 21 is stopped.

By reason of the vacuum caused by the action of the pump 3, the dust, together with the surrounding air is drawn through the nozzle 50 from the carpet or other surface against which the latter is held, and passing through the flexible conduit 37, it enters the separator 32 in which the larger particles such as cigar-stumps, nails etc., are arrested by the screen 33. The check valve 48 prevents the air from flowing in opposite direction. The air, proceeding from the separator 32, through the conduit 31, enters the cleansing device, where the dust carried thereby, assimilates with the water as hereinbefore described. The purified air issuing from the reservoir, passes through the conduits 15 and 19 to the pump and from there through the oil separator 26, to the exhaust pipe 20.

Attention is called to the fact that our improved system may be effectively employed to supply the rooms of a dwelling or other building with refrigerant, salted or medicated air, by cooling the reservoir 6 or by introducing the required medicinal or other substance into the water contained therein, a feature which will be found beneficial in hospitals and sick-rooms.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:—

1. In an air cleaning system in combination, an air impelling element; a reservoir; a conduit connection between said reservoir and the inlet port of said element; an air intake arranged in said conduit; a separate conduit connection between said reservoir and the egress port of said element said conduit having an air exhaust; an additional conduit connection between said reservoir and the first named conduit, and provided with an open nozzle connection; and a pair of coöperating controlling valves arranged in said first and second named conduits and connected together for simultaneous operation, said valves being adapted to simultaneously connect the inlet port with said intake only and interrupt communication between said exhaust and the egress port, while maintaining the latter in communication with said reservoir, when in one position, and to simultaneously interrupt communication between said intake and the inlet port, while maintaining said inlet port in communication with said reservoir, and to connect said egress port with said exhaust only when in another position.

2. In an air controlling system, in combination, an air impelling element; a reservoir; a conduit connection between said reservoir and the inlet port of said element; an air intake arranged in said conduit; a separate conduit connection between said reservoir and the egress port of said element said conduit having an air exhaust; an additional conduit connection between said reservoir and the first named conduit, and provided with an open nozzle connection; a pair of coöperative controlling valves arranged in said first and second named conduits and connected together for simultaneous operation, said valves being adapted to simultaneously connect the inlet port with said intake only and interrupt communication between said exhaust and the egress port, while maintaining the latter in communication with said reservoir, when in one position, and to simultaneously interrupt communication between said intake and the inlet port, while maintaining said inlet port in communication with said reservoir, and to connect said egress port with

said exhaust only when in another position; and means connected with said valves for operating the same from any selected elevation within fixed limits.

3. In an air-cleaning system, an air impelling element, a reservoir, a conduit connecting the ingress side of said element with said reservoir, an air intake connected with said conduit, a second conduit connecting the egress side of said element with said reservoir and having a check-valve arranged to prevent passage of fluid from the latter, an air outlet connected with said second conduit, a third conduit connecting said reservoir with the first named conduit and having an orifice intermediate its ends, the said third conduit having a check-valve arranged to interrupt passage of fluid from said reservoir to said orifice and a check-valve arranged to prevent the passage of fluid entering the orifice, to the first named conduit, a valve associated with the latter and adapted to connect the egress-side of the element with either the intake or with said reservoir; and a second valve associated with the second conduit and coöperatively connected with the first named valve, so as to connect the egress side of the said element with the reservoir in the first instance and with said outlet in the second instance.

In testimony whereof we have affixed our signatures in presence of two witnesses.

GEORGE J. KINDEL.
ARTHUR W. KINDEL.

Witnesses:
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M. L. GEARY.