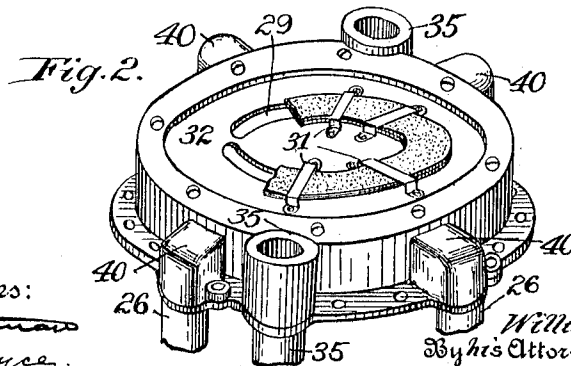
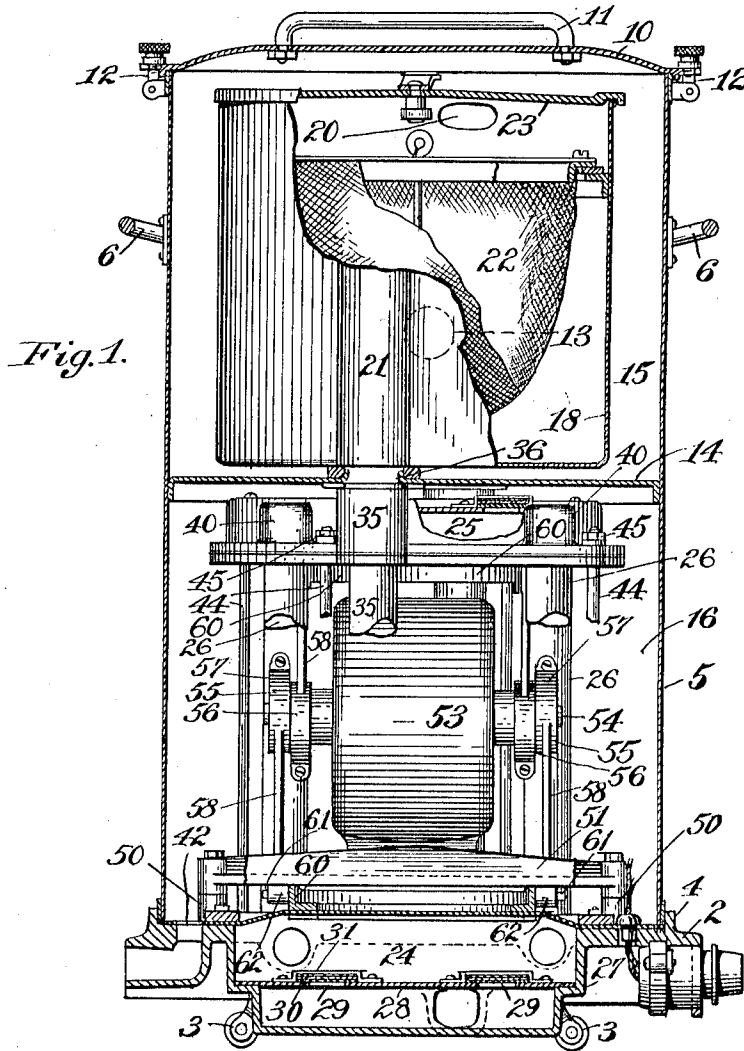


W. H. RAKESTRAW.
VACUUM CLEANER.
APPLICATION FILED MAR. 7, 1911.

1,020,310.

Patented Mar. 12, 1912.

2 SHEETS—SHEET 1.



Witnesses:
R. M. Pittman
F. C. Boyce.

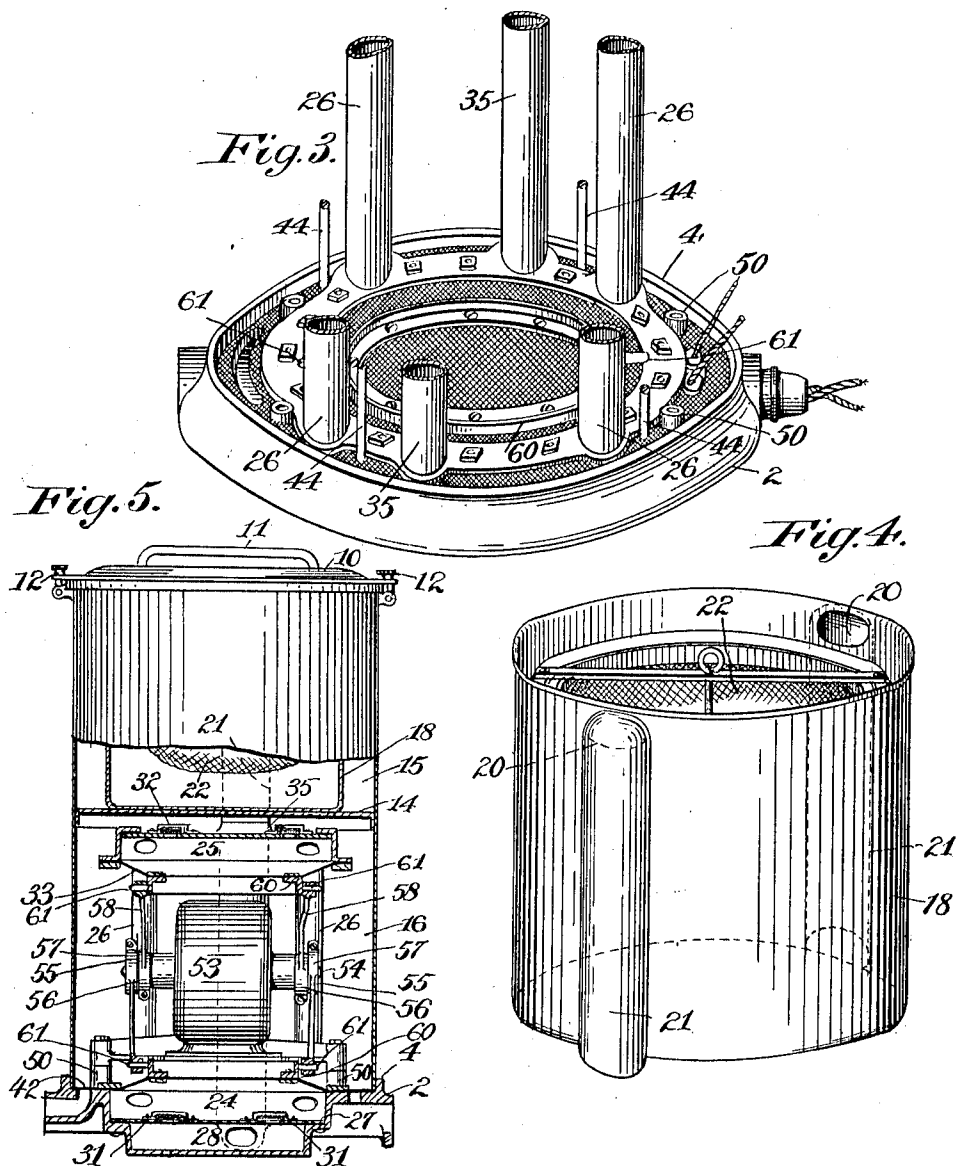
Inventor,
William H. Rakestraw
By his Attorney *C. H. Reed*

W. H. RAKESTRAW.
VACUUM CLEANER.
APPLICATION FILED MAR. 7, 1911.

1,020,310.

Patented Mar. 12, 1912.

2 SHEETS—SHEET 2.



Witnesses:
R. M. Pittman
F. E. Boyce.

Inventor
William H. Rakestraw
By his Attorney
C. H. Reed

UNITED STATES PATENT OFFICE.

WILLIAM H. RAKESTRAW, OF BLOOMINGTON, ILLINOIS, ASSIGNOR TO AUTOMATIC VACUUM CLEANER COMPANY, OF BLOOMINGTON, ILLINOIS, A CORPORATION OF ILLINOIS.

VACUUM-CLEANER.

1,020,310.

Specification of Letters Patent.

Patented Mar. 12, 1912.

Application filed March 7, 1911. Serial No. 612,814.

To all whom it may concern:

Be it known that I, WILLIAM H. RAKESTRAW, a citizen of the United States, residing at Bloomington, in the county of Mc-
Clean and State of Illinois, have invented
certain new and useful Improvements in
Vacuum-Cleaners, of which the following is
a specification.

This invention relates to vacuum cleaners,
more particularly to that class thereof
known as portable vacuum cleaners, and is
in part an improvement upon my contemporane-
ously pending application Serial No.
585,193, filed October 4, 1910, the object of
the invention being to provide a power, such
as a motor driven, machine in which the motor
will be so supported and connected with
the pumping mechanism that vibration
thereof will be reduced to a minimum, and
in which the inlet and outlet valves will be
so located in connection with this improved
form of pumping mechanism that a more
positive and efficient operation thereof is obtained.

A further object of the invention is the
provision of an improved vacuum cleaner
embodying a pair of pumps spaced apart
and operated in unison both to draw in air
simultaneously at one time and to expel the
same simultaneously at another time by driving
means, preferably in the form of a motor,
located between the pumps, this organization
permitting the proper balancing of the
driving means and eliminating substantially
all vibration of the machine, and in
which organization one of such pumps will
be provided with an inlet valve mechanism
and the other with an outlet valve mechanism
so constructed and located that both of
the valves will seat by gravity, thus obviating
the use of springs to assist the seating
of the valves and preventing the blowing
back of the air through the valve before it
seats.

In vacuum cleaning machines in which
one or both of the valves seat upwardly such
valves do not act quickly enough unless
springs or other means are used to assist in
the seating of the valves, and in consequence
the proper amount of air is not displaced, as
a part of such air blows back through the
valves before they seat. The use of springs,
however, to prevent this is objectionable,

and leather valves stretched over a convex
surface are also objectionable for the reason
that the leather will stretch in use and will
not perform the operation satisfactorily.
Another disadvantage in power-driven vacuum
cleaners is the tremendous amount of
vibration caused by the motor, owing to the
manner in which it has been supported and
connected with the pumping mechanism. In
the present instance, however, an organization
is provided in which the pumping
mechanism and motor mechanism are so located
relatively to each other that a proper
balancing of the driving means is provided
and substantially all vibration eliminated,
while at the same time the valves are so
formed and located that they will seat by
gravity, thus obviating the necessity of
using leather stretched over a convex surface
or springs to assist in the seating of the
valves, while at the same time providing
a very simple and comparatively inexpensive
and highly efficient vacuum cleaning
apparatus, which may also be used effectively
not only to suck in dirt but as a blowing
apparatus.

In the drawings accompanying and forming
part of this specification, Figure 1 is a
vertical sectional view of this improved
vacuum cleaner; Fig. 2 is a perspective view
of the upper pumping chamber and the outlet
valve detached from the machine; Fig. 3
is a perspective view of the lower pumping
chamber likewise detached from the machine,
with the connecting air passages broken away;
Fig. 4 is a side elevation of one form of dirt
separating means and which forms a part of
the vacuum chamber; and Fig. 5 is partly a
side elevation and partly a sectional view of
this improved machine.

Similar characters of reference indicate
corresponding parts throughout the figures
of the drawings.

In the preferred form thereof herein
shown and described, this improved portable
vacuum cleaner comprises a suitable
base 2 provided with some suitable form of
casters 3 whereby it may be readily moved
around the room or from one place to
another. This base has an upwardly extending
annular flange 4 for the reception of a
cylindrical casing 5 provided with han-

dles 6. This casing or receptacle is secured to the base by suitable fastening devices. A cover 10 provided with a suitable handle 11 closes the upper end of this cylindrical casing, it being secured thereto by suitable locking devices 12. The casing is provided with a suitable opening 13 for the attachment of the inlet suction hose and nozzle. This casing is divided between its ends by a horizontally located partition 14 forming a pair of compartments or chambers 15 and 16, one, as 15, constituting to a certain extent what may be considered a vacuum reservoir or chamber in which a suitable dirt separating means may be located, and the other, as 16, constituting an exhaust chamber in which the pumping mechanism and driving means are located. In the present instance, however, the dirt separating means is shown in the form of a receptacle 18 located within the chamber 15 and in communication with the inlet opening of the chamber 15. This receptacle is in the form of a metal can 19 having adjacent to its top a pair of outlets 20 communicating with tubular passageways 21 formed on the outer side of the can, the lower ends of which tubular passageways are in communication with a pair of tubes 35 hereinafter described. Located within this receptacle or can is a suitable dirt separating means, shown in the form of a bag 22, which in the present instance is substantially the same as that shown in my contemporaneously pending application hereinbefore referred to and a further description thereof is therefore deemed unnecessary. The receptacle is provided with a cover 23 securely clamped thereto in substantially the same manner as shown in my contemporaneously pending application. This dirt receptacle in the present construction of machine thus forms the vacuum chamber or reservoir, although it will be obvious that this receptacle could be dispensed with and the upper compartment of the casing constitutes the vacuum reservoir or chamber and support any suitable dirt separating means which it may be desired to use.

In the present instance it will be observed that the dirt and dust is drawn into the vacuum chamber at the outer side of the bag, so that it tends to settle by gravity in the can below the bag, while the purified air passes through the bag from the outer sides thereof to the outlet openings hereinbefore described.

In my contemporaneously pending application hereinbefore referred to the pumping mechanism is similar in some respects to that shown herein. In that case, however, the air is drawn in from one pump chamber to another through tubes and is expelled through the same tubes and the inlet valve and the outlet valve mechanism is located in the up-

per pump chamber, in consequence of which it is impossible that both valves seat by gravity. In the present instance, while the pumps are spaced apart in a similar manner to that shown in my prior application, the air is drawn in through one set of tubes and expelled through another, while the inlet valve is located in the lower pump chamber and the exhaust valve in the upper pump chamber, thus enabling not only both valves to seat by gravity, but a somewhat more efficient operation of the cleaner.

The pumping mechanism located in the exhaust chamber of the casing comprises a pair of pumps 24 and 25, each consisting of an air chamber, one, as 24, being supported by and adjacent to the base of the machine, and in practice it is preferably formed as an integral structure therewith. The upper air chamber, as 25, is spaced apart from and in the present instance is supported above the lower air chamber by a plurality of tubes 26. The lower chamber 24 is closed at its upper side by a suitable diaphragm formed of any suitable material, the outer edge thereof being secured to the base of the machine by a suitable clamping ring. This lower chamber 24 is formed with an annular shoulder or wall 27 for the reception of the valve, which in the present instance forms the inlet valve of the pumping mechanism. This valve consists simply of a disk 28 of some suitable material having a plurality of elongated arc-shaped slots 29 on which is laid an annular member 30 constituting the valve proper. This member may consist of any suitable material, but is shown in the present instance as made of three thicknesses of leather glued or otherwise secured together, it being held in proper position by suitable U-shaped brackets or members 31 so that the valve will not lift too far from its opening. It will thus be observed that the valve seats itself by gravity, it being lifted by the action of the pump to permit the ingress of air in the manner hereinafter described. The lower side of the upper pump chamber is likewise provided with a similarly formed diaphragm 33, while the opposite or uppermost side of such chamber is provided with a similarly formed valve 32 carried by a similar disk to that hereinbefore described, the valve being located at the upper side of the disk and in the position shown in Fig. 2, so that it likewise seats itself by gravity. This valve constitutes the outlet or exhaust valve of the pumping mechanism.

As hereinbefore stated, the two pumps are connected by air passages in the form of tubes. In the present instance two of these tubes, as 35, communicate with the lower pump chamber at the lower side of the valve, while the upper ends thereof are in

communication with the tubes 21 of the dirt separating can or vacuum chamber, for which purpose the partition 14 hereinbefore referred to dividing the casing into a vacuum chamber and an exhaust chamber is provided with openings 36 around which will be provided suitable packing so that the communication between the tubes 21 and 35 will be air-tight. The remaining tubes, preferably shown as four in number, communicate with the lower pump chamber at the upper side of its valve and with the upper pump chamber at the underside of the upper valve. All of these tubes may be removable and in the present instance they are shown as fitting into sockets formed in the rings by means of which the diaphragms are secured in position on the castings forming respectively the base of the machine and the upper pump chamber, and which castings are provided with housed or closed ports 40 in communication with the ends of the tubes, excepting those two ports which communicate with the tubes 21 of the vacuum chamber, which ports are open at their undersides for the reception of the tubes 35 and at their upper sides for communication with the tubes 21 of the vacuum chamber. By providing a pair of inlet air passages, as 21 and 35, the intake of air is more evenly and properly balanced and by providing a plurality of tubes oppositely disposed the exhaust of the air is likewise more evenly balanced. These tubes likewise form pillars for supporting the two pumps spaced apart one above the other and in linear alinement with the vacuum chamber and with the driving mechanism. The exhaust valve carried by the upper pump opens into the casing below the horizontal partition thereof, so that the air is expelled or exhausted into this casing, from which it passes by a port 42 located in the base of the machine, which port is shown as an elongated slot formed in the base of the machine in communication with the outside of such base and to which may be attached a hose if it is desired to use the machine as a blower.

Each of the pump chambers is formed as a casting, the lower pump being formed as an integral part of the base, as hereinbefore stated, while the upper pump is supported by the tubes hereinbefore described, the two pumps being connected by suitable rods 44 and nuts 45, whereby the two pumps are held together and in tight engagement with the air tubes.

From the foregoing it will be observed that the air or pump chambers are supported by a plurality of tubes, a pair of which serve as the air intake tubes communicating with the vacuum chamber and with one of said pumps, while the remainder connect the two pumps together and serve as air exhaust

passages, so that in the operation of the pumps air will be sucked in from the vacuum chamber through the intake tubes into the lower compartment of the lower pump, from whence it passes through the valve into the upper compartment of such pump and from thence through the air exhaust tubes to the upper pump below the valve, and from thence through the valve into the casing surrounding the pumping mechanism and out therefrom into the atmosphere, so that in the present improvement certain of the tubes act as the air intake tubes, while the remainder act as the air exhaust tubes, thus providing a very efficient pumping mechanism.

Supported on suitable posts 50 carried by the base is a motor supporting member or platform 51 adapted to support the driving mechanism, such as an electric motor 53. This platform extends from side to side of the base above the lower diaphragm, the posts 50 raising it sufficiently above the base to give free and proper action to the diaphragm. Any suitable form of motor adapted for the purpose may be used. On each end of the shaft 54 of the motor is located a pair of eccentrics 55 and 56 disposed side by side, the eccentric portion of one of such eccentrics being diametrically opposite to the eccentric portion of the other eccentric. Located on each of these eccentrics is a strap 57 having a connecting rod 58, so that the connecting rods of the pumps extend in opposite directions, or one of each pair down and one up in the present arrangement of the machine. The outer end of each connecting rod is pivotally connected to a diaphragm, and for this purpose each diaphragm is provided centrally with a head or ring 60, to which the diaphragm is secured, and this ring is provided with oppositely located alined studs or pivots 61 projecting into bearings 62 on the rods. By this organization it will be observed that both diaphragms of the two air or pump chambers are moved in unison at one time toward each other and at another time away from each other, so that both pumps operate simultaneously to draw in air at one time and simultaneously to expel such air at another time, and as the motor is supported between these two pumps and connected therewith by means of the diametrically opposed connecting rods it will be observed that the mechanism is balanced and vibration of the motor is avoided. Some suitable form of antifriction bearings will be located between the connecting rod straps and the eccentrics of the motor shaft.

It will of course be understood that suitable packing will be used at those points where such is required, but very little of such packing is required in the present construction of machine by reason of the manner in which it is organized and constructed.

In order that the inlet tubes 35 may communicate with the lower compartment of the lower pump chamber the ports in the casting into which these tubes project are
5 formed of greater length than the ports into which the tubes forming the exhaust set of tubes project, so that the first pair of ports will thus open into the lower compartment of the pump below the valve.

10 In operation the dirt and dust drawn through the nozzle renovator, not shown, and the suction hose, not shown, enters the dirt and dust separator or vacuum chamber at the outer side of the bag or other separating material, where, as hereinbefore
15 stated, the larger proportion of the dust and dirt settles in the vacuum chamber, the purified air passing through the walls of the bag and through the two outlet tubes 21 and from thence through the tubes 35 to the lower compartment of the lower pump and through the valve into the upper compartment of such pump, and therefrom
20 through the outlet or exhaust tubes into the upper pump chamber below the valve. On the next stroke of the pumps the air remaining in the upper compartment of the lower pump and in the air chamber of the upper pump is expelled therefrom through the
25 valve of the upper pump on the opening of the same by the action of the pump and into the casing surrounding the pumping mechanism, from which it is forced into the atmosphere. Thus it will be observed
30 that on the inward movement of both diaphragms toward the motor air is drawn in through the inlet valve in the lower pump chamber to the two pump chambers, one above this valve and the other below the
35 upper valve, while on both outward strokes of the diaphragm this same air is expelled or forced out through the upper or outlet valve of the upper pump chamber, both pumps thus operating in unison from
40 the same shaft, so that by placing the pumps opposite to each other and one at each side of the power the pumping mechanism is perfectly balanced on the driving shaft and all vibration is overcome, and not
45 only this, but less power is required to displace the same amount of air, as the eccentrics are only offset from the center about half of what would be necessary in a machine with one pump located at one side
50 thereof, and at the same time the valves of both pumping chambers seat themselves by gravity, a very desirable and highly efficient construction. The motor is electrically connected with the base in some suitable manner whereby on the insertion of the usual
55 plug carrying the cord the cleaner may be thrown into operation on the operation of the proper switch.

I claim as my invention:

65 1. In a vacuum cleaning apparatus, the

combination with a casing having a vacuum chamber, of vacuum creating means connected therewith and comprising a pair of diaphragm air pumps spaced apart and operative simultaneously and in unison both
70 to draw in or to expel air, an electric motor located between and connected with each of the pumps to operate them in unison and simultaneously, hollow pillars supporting said pumps spaced apart and forming a
75 plurality of air passages, one or more connecting the vacuum chamber with one of the pumps for the air intake and one or more different air passages connecting said pumps for the air exhaust, and a gravity
80 seating valve for each of said pumps, one controlling the admission of air to both of the pumps and the other the exhaust of air from said pumps, the air passing from the vacuum chamber to one pump and from
85 thence to the other pump and then into the casing.

2. In an exhaust chamber a vacuum cleaning apparatus, the combination of a vacuum chamber, a vacuum creating means
90 connected with the vacuum chamber and comprising a pair of pumps spaced apart, driving means located within said exhaust chamber and between said pumps and operating the pumps in unison simultaneously
95 to draw in or expel air, said pumps having a plurality of air passages one or more forming an air intake passage and one or more connecting said pumps and forming an air exhaust passage, and valve mechanism separating one of said pumps into a
100 pair of compartments, the valve thereof seating by gravity.

3. In a vacuum cleaning apparatus, the combination of a vacuum chamber, a
105 vacuum creating means connected therewith and comprising a pair of pumps spaced apart, driving means located between said pumps and operating the pumps in unison simultaneously to draw in or expel air, said
110 pumps having a plurality of air passages one or more forming an air intake passage and one or more connecting said pumps and forming an air exhaust passage, valve mechanism separating one of said pumps into a
115 pair of compartments, and valve mechanism in the other of said pumps, one of said valve mechanisms controlling the intake of air and the other the exhaust thereof and the valves of both mechanisms seating by
120 gravity, the exhaust air passing through both of said pumps before its discharge from one of them.

4. In a vacuum cleaning apparatus, the combination of a vacuum chamber, a
125 vacuum creating means connected therewith and comprising a pair of pumps spaced apart one above the other, a motor located between said pumps and operating the pumps in unison simultaneously to draw in
130

or expel air, valve mechanism connected with each of said pumps, one of said valve mechanisms separating one of said pumps into a pair of compartments, an air passage or passages communicating with the vacuum chamber and with a compartment of one of said pumps, and an air passage or passages communicating with the other compartment of said pump and with the other pump.

5. In a vacuum cleaning apparatus, the combination of a vacuum chamber, a vacuum creating means connected therewith and comprising a pair of pumps spaced apart one above the other, a motor located between said pumps and operating the pumps in unison simultaneously to draw in or expel air, valve mechanism connected with each of said pumps, one of said valve mechanisms separating one of said pumps into a pair of compartments, an air passage or passages communicating with the vacuum chamber and with a compartment of one of said pumps, an air passage or passages communicating with the other compartment of said pump and with the other pump, and a valve connected with each of said pumps and respectively controlling the intake and exhaust of air, each of said valves seating by gravity.

6. In a vacuum cleaning apparatus, the combination of a vacuum chamber, a vacuum creating means connected therewith and comprising a pair of pumps spaced apart, a motor located between said pumps and operating the pumps in unison simultaneously to draw in or expel air, hollow pillars supporting said pumps spaced apart one or more communicating with the vacuum chamber and with one of said pumps and forming an air intake passage and one or more connecting said pumps together and forming an air exhaust passage, and a valve connected with each of said pumps one separating one of said pumps into a pair of compartments and the intake passage from the exhaust passage.

7. In a vacuum cleaning apparatus, the combination of a supporting base, a vacuum pump located therein, a valve separating said pump into a pair of compartments, pillars supported on said base and forming air passages one or more in communication with one of said compartments and one or more in communication with the other of said compartments, a pump supported by said pillars and with which one or more of said air passages are in communication, a vacuum chamber in communication with one or more of said air passages, a valve connected with said last pump, and a motor also supported by said base and located between said pumps and connected therewith for driving said pumps in unison simultaneously to draw in or expel air.

8. In a vacuum cleaning apparatus, the

combination of a supporting base, a vacuum pump located therein, a valve separating said pump into a pair of compartments, pillars supported on said base and forming air passages one or more in communication with one of said compartments and one or more in communication with the other of said compartments, a pump supported by said pillars and with which one or more of said air passages are in communication, a vacuum chamber in communication with one or more of said air passages, a valve connected with said last pump, a motor also supported by said base and located between said pumps and connected therewith for driving said pumps in unison simultaneously to draw in or expel air, and a casing also supported by said base and surrounding the pillars and motor and into which the exhausted air is expelled, said casing having an outlet.

9. In a vacuum cleaning apparatus, the combination of a supporting base, a vacuum pump located therein, a valve separating said pump into a pair of compartments, pillars supported on said base and forming air passages one or more in communication with one of said compartments and one or more in communication with the other of said compartments, a pump supported by said pillars and with which one or more of said air passages are in communication, a vacuum chamber in communication with one or more of said air passages, a valve connected with said last pump, a motor also supported by said base and located between said pumps and connected therewith for driving said pumps in unison simultaneously to draw in or expel air, and a casing also supported by said base and surrounding the pillars and motor and into which the exhausted air is expelled, said casing having an outlet, and said casing also having a partition separating said vacuum chamber from the pumping mechanism.

10. In a vacuum cleaning apparatus, the combination of a supporting base, a pump therein, a diaphragm for said pump, an inlet valve in said pump and separating the same into a pair of compartments and seating by gravity, hollow supporting pillars carried by said base and forming air passages, a pump supported by said pillars and having a diaphragm, an exhaust valve connected with said pump and seating by gravity, some of said pillars connecting the upper compartment of the lower pump and the upper pump and some of said pillars communicating with the lower compartment of said lower pump, and a vacuum chamber in communication with said last pillar or pillars.

11. In a vacuum cleaning apparatus, the combination of a supporting base, a pump therein, a diaphragm for said pump, an inlet valve in said pump and separating the same into a pair of compartments and seating by

gravity, hollow supporting pillars carried by said base and forming air passages, a pump supported by said pillars and having a diaphragm, an exhaust valve connected
 5 with said pump and seating by gravity, some of said pillars connecting the upper compartment of the lower pump and the upper pump and some of said pillars communicating with the lower compartment of said
 10 lower pump, a vacuum chamber in communication with said last pillar or pillars, and a motor located between said pumps and operating the diaphragms thereof in unison simultaneously to draw in or expel air.

12. In a vacuum cleaning apparatus, the combination of a supporting base, a pump therein, a diaphragm for said pump, an inlet valve in said pump and separating the same into a pair of compartments and seating by gravity, hollow supporting pillars
 20 carried by said base and forming air passages, a pump supported by said pillars and having a diaphragm, an exhaust valve connected with said pump and seating by gravity, one or more of said pillars connecting
 25 the upper compartment of the lower pump and the upper pump and one or more of said pillars communicating with the lower compartment of said lower pump, a vacuum
 30 chamber in communication with said last pillar or pillars, a motor located between said pumps and operating the diaphragms thereof in unison simultaneously to draw in or expel air, and a casing surrounding said
 35 pump and motor mechanism and into which the exhaust air is expelled.

13. In a vacuum cleaning apparatus, the combination of a supporting base, a pump therein, a diaphragm for said pump, an inlet valve in said pump and separating the same into a pair of compartments and seating by gravity, hollow supporting pillars
 40 carried by said base and forming air passages, a pump supported by said pillars and having a diaphragm, an exhaust valve connected with said pump and seating by gravity, one or more of said pillars connecting
 45 the upper compartment of the lower pump and the upper pump and one or more of said pillars communicating with the lower compartment of said lower pump, a vacuum chamber in communication with said last
 50 pillar or pillars, a motor located between said pumps and operating the diaphragms thereof in unison simultaneously to draw in or expel air, and a casing surrounding said pump and motor mechanism and into which
 55 the exhaust air is expelled, said casing having a separating partition dividing said vacuum chamber from the pumping mechanism.

14. In a vacuum cleaning apparatus, the combination of a vacuum chamber, pumping mechanism comprising a pair of pump chambers spaced apart and a diaphragm in each
 65

of said chambers, a motor located between said pumps and connected to the diaphragms for operating the same in unison simultaneously to draw in or expel air, a valve carried by each of said chambers one comprising an inlet valve and the other an exhaust
 70 valve and one of said valves dividing one of said chambers into a pair of compartments, one or more tubes in communication with the vacuum chamber and with one of said compartments, and tubes connecting the
 75 other of said compartments of the same pump chamber with the other of said pump chambers.

15. In a vacuum cleaning apparatus the combination of a vacuum chamber, an exhaust chamber, pumping mechanism comprising a pair of pump chambers spaced apart and located within the exhaust chamber and a diaphragm in each of said chambers, a motor located between said pumps
 80 and also located within the exhaust chamber and connected to the diaphragms for operating the same in unison simultaneously to draw in or expel air, a valve carried by each of said chambers one comprising an inlet
 85 valve and the other an exhaust valve and one of said valves dividing one of said chambers into a pair of compartments, one or more tubes in communication with the vacuum chamber and with one of said compartments, and tubes connecting the other
 90 of said compartments of the same pump chamber with the other of said pump chambers, each of said valves seating by gravity.

16. In a vacuum cleaning apparatus, the combination of a vacuum chamber, pumping mechanism comprising a pair of pump chambers spaced apart and a diaphragm in each of said chambers, a motor located between
 105 said pumps and connected to the diaphragms for operating the same in unison simultaneously to draw in or expel air, a valve carried by each of said chambers one comprising an inlet valve and the other an exhaust valve and one of said valves dividing one of said chambers into a pair of
 110 compartments, one or more tubes in communication with the vacuum chamber and with one of said compartments, tubes connecting the other of said compartments of the same pump chamber with the other of said pump chambers, each of said valves
 115 seating by gravity, and a casing inclosing said pumping mechanism and into which the air is exhausted.

17. In a vacuum cleaning apparatus, the combination of a vacuum chamber, pumping mechanism comprising a pair of pump chambers spaced apart and a diaphragm in each of said chambers, a motor located between
 125 said pumps and connected to the diaphragms for operating the same in unison simultaneously to draw in or expel air, a valve carried by each of said chambers one comprising

70

75

80

85

90

95

100

105

110

115

120

125

130

ing an inlet valve and the other an exhaust valve and one of said valves dividing one of said chambers into a pair of compartments, one or more tubes in communication with the vacuum chamber and with one of said compartments, tubes connecting the other of said compartments of the same pump chamber with the other of said pump chambers, each of said valves seating by gravity, and a casing inclosing said pumping mechanism and into which the air is exhausted, said casing also inclosing the vacuum chamber and having a partition separating the same from the air exhaust chamber thereof.

18. In a vacuum cleaning apparatus, the combination of a casing having a partition separating the same into a vacuum chamber and an exhaust chamber, a pair of diaphragm pumps spaced apart and located in said exhaust chamber, a motor located between said pumps for driving the same in unison simultaneously to draw in or expel air, a valve connected with each of said pumps and seating by gravity, one of said valves separating one of the pumps into a pair of compartments, an air inlet passage communicating with the vacuum chamber and with one of said compartments, and an air outlet passage communicating with the other compartment of the pump and with the other pump.

19. In a vacuum cleaning apparatus, the combination of a casing having a partition separating the same into a vacuum chamber and an exhaust chamber, a pair of diaphragm pumps spaced apart and located in said exhaust chamber, a motor located between said pumps for driving the same in unison simultaneously to draw in or expel air, a valve connected with each of said pumps and seating by gravity, one of said valves separating one of the pumps into a pair of compartments, an air inlet passage communicating with the vacuum chamber and with one of said compartments, and an air outlet passage communicating with the other compartment of the pump and with the other pump, said passages consisting of pillars for supporting one pump above the other.

20. In a vacuum cleaning apparatus, the combination of a pair of diaphragm pumps spaced apart, a motor located between said pumps and connected with the diaphragms thereof and operating the same in unison simultaneously to draw in or expel air, valve mechanism connected with each of said pumps and comprising a member having one or more openings therein, an annular valve located in position to control said openings and seating by gravity, one of said valve mechanisms dividing one of said pumps into a pair of compartments, a vacuum chamber in communication with one of said compartments,

and the other of said compartments being in communication with the other of said pumps.

21. In a vacuum cleaning apparatus, the combination of a pair of diaphragm pumps spaced apart, a motor located between said pumps and connected with the diaphragms thereof and operating the same in unison simultaneously to draw in or expel air, valve mechanism connected with each of said pumps and comprising a member having one or more openings therein, an annular valve located in position to control said openings and seating by gravity, one of said valve mechanisms dividing one of said pumps into a pair of compartments, and a vacuum chamber in communication with one of said compartments, the other of said compartments being in communication with the other of said pumps, said communications being formed by hollow pillars constituting means for supporting one pump spaced apart from the other.

22. In a vacuum cleaning apparatus, the combination of a pair of diaphragm pumps spaced apart, a motor located between said pumps and connected with the diaphragms thereof and operating the same in unison simultaneously to draw in or expel air, valve mechanism connected with each of said pumps and comprising a member having one or more openings therein, an annular valve located in position to control said openings and seating by gravity, one of said valve mechanisms dividing one of said pumps into a pair of compartments, and a vacuum chamber in communication with one of said compartments, the other of said compartments being in communication with the other of said pumps, said communications being formed by hollow pillars constituting means for supporting one pump spaced apart from the other, and means for clamping said pumps in position.

23. In a vacuum cleaning apparatus, the combination of a pair of diaphragm pumps spaced apart, a motor located between said pumps and connected with the diaphragms thereof and operating the same in unison simultaneously to draw in or expel air, valve mechanism connected with each of said pumps and comprising a member having one or more openings therein, an annular valve located in position to control said openings and seating by gravity, one of said valve mechanisms dividing one of said pumps into a pair of compartments, a vacuum chamber in communication with one of said compartments, the other of said compartments being in communication with the other of said pumps, and a casing surrounding said pumping mechanism and having an outlet.

24. In a vacuum cleaning apparatus, the combination of a pair of diaphragm pumps spaced apart, a motor located between said

pumps and connected with the diaphragms thereof and operating the same in unison simultaneously to draw in or expel air, valve mechanism connected with each of said pumps and comprising a member having one or more openings therein, an annular valve located in position to control said openings and seating by gravity, one of said valve mechanisms dividing one of said pumps into a pair of compartments, a vacuum chamber in communication with one of said compartments, the other of said compartments being in communication with the other of said pumps, and a casing surrounding said pumping mechanism and having an outlet, said casing having a partition separating the vacuum chamber from the chamber in which the pumping mechanism is located.

25. In a vacuum cleaning apparatus, the combination of a pair of diaphragm pumps spaced apart, a motor located between said pumps and connected with said diaphragms for operating the same in unison simultaneously to draw in or expel air, a valve connected with each of said pumps, one of said valves separating one of said pumps into a pair of compartments, and a vacuum chamber having a pair of oppositely disposed air passages in communication with one of said compartments and the other of said compartments having communication by a plurality of air passages with the other of said pumps.

26. In a vacuum cleaning apparatus, the combination of a pair of diaphragm pumps spaced apart, a motor located between said pumps and connected with said diaphragms for operating the same in unison simultaneously to draw in or expel air, a valve connected with each of said pumps, one of said valves separating one of said pumps into a pair of compartments, and a vacuum chamber having a pair of oppositely disposed air passages in communication with one of said compartments and the other of said compartments having communication by a plurality of air passages with the other of said pumps, said air passages being formed by tubes supporting one pump upon the other, and a casing inclosing said mechanism and separable from said tubes.

27. In a vacuum cleaning apparatus, the combination of a pair of diaphragm pumps spaced apart, a motor located between said pumps and connected with the diaphragms thereof for operating the same in unison simultaneously to draw in or expel air, a valve connected with each of said pumps, one of said valves separating one of said pumps into a pair of compartments, and a vacuum chamber having a pair of oppositely disposed air passages in communication with one of said compartments and the other of said compartments having communication by a plurality of air passages with the other

of said pumps, said air passages being formed by tubes supporting one pump above the other and said valves seating by gravity.

28. In a vacuum cleaning apparatus, the combination of a pair of diaphragm pumps spaced apart, a motor located between said pumps and connected with the diaphragms thereof for operating the same in unison simultaneously to draw in or expel air, a valve connected with each of said pumps, one of said valves separating one of said pumps into a pair of compartments, a vacuum chamber having a pair of oppositely disposed air passages in communication with one of said compartments and the other of said compartments having communication by a plurality of air passages with the other of said pumps, said air passages being formed by tubes supporting one pump above the other and said valves seating by gravity, and a casing surrounding said pumping mechanism and having a chamber separated from said pumping mechanism.

29. In a vacuum cleaning apparatus, the combination of a vacuum chamber, pumping mechanism connected therewith and comprising a pair of pump chambers spaced apart and each having a diaphragm, driving mechanism for operating said diaphragms in unison thereby simultaneously to draw in or expel air, an exhaust valve connected with one of said pumps, an inlet valve connected with the other of said pumps and dividing the same into a pair of compartments, one of said compartments having communication with the vacuum chamber and the other of said compartments having communication with the other pump.

30. In a vacuum cleaning apparatus, the combination of a vacuum chamber, pumping mechanism connected therewith and comprising a pair of pump chambers spaced apart and each having a diaphragm, driving mechanism for operating said diaphragms in unison thereby simultaneously to draw in or expel air, an exhaust valve connected with one of said pumps, and an inlet valve connected with the other of said pumps and dividing the same into a pair of compartments, one of said compartments having communication with the vacuum chamber and the other of said compartments having communication with the other pump, said valves seating by gravity, the organization being such that air from the vacuum chamber will be drawn through one of said compartments into the other of said compartments and from thence expelled through the other of said pumps.

31. In a vacuum cleaning apparatus, the combination of a vacuum chamber, pumping mechanism connected therewith and comprising a pair of pumps, means for driving said pumps in unison thereby simultaneously to draw in or expel air, a valve for each of

said pumps one separating one of said
pumps into a pair of compartments, the
organization being such that air will be
drawn into one of the compartments of said
5 pump and from thence into the other com-
partment thereof and will then be expelled
therefrom through the other pump.

Signed at Bloomington, Ill., this 4th day
of March, 1911.

WILLIAM H. RAKESTRAW.

Witnesses:

HUBERT D. BATH,
E. J. DONNELLY.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
Washington, D. C."

It is hereby certified that in Letters Patent No. 1,020,310, granted March 12, 1912, upon the application of William H. Rakestraw, of Bloomington, Illinois, for an improvement in "Vacuum-Cleaners," errors appear in the printed specification requiring correction as follows: Page 2, line 46, for the word "constitutes" read *constitute*; page 3, line 7, before the word "suitable" insert the article *a*; page 4, lines 88-90, strike out the words "In an exhaust chamber a vacuum cleaning apparatus, the combination of a vacuum" and insert the words *In a vacuum cleaning apparatus, the combination of a vacuum chamber, an exhaust*; page 7, line 37, for the syllable "phragrm" read *phragm*, and same page, line 102, for the word "communication" read *communication*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 2nd day of April, A. D., 1912.

[SEAL.]

C. C. BILLINGS,
Acting Commissioner of Patents.