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2 SHEETS-SHEET 1.



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VACUUM CLEANING APPARATUS.

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974,286.

Patented Nov. 1, 1910.

2 SHEETS-SHEET 2.

Fig. 2.

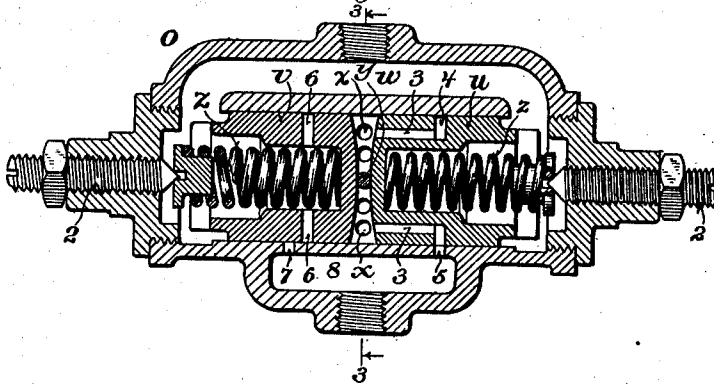


Fig. 3.

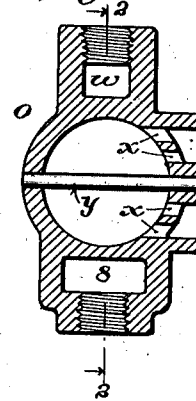


Fig. 4.

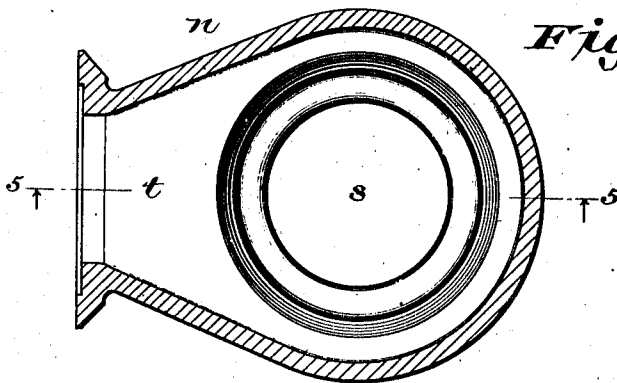
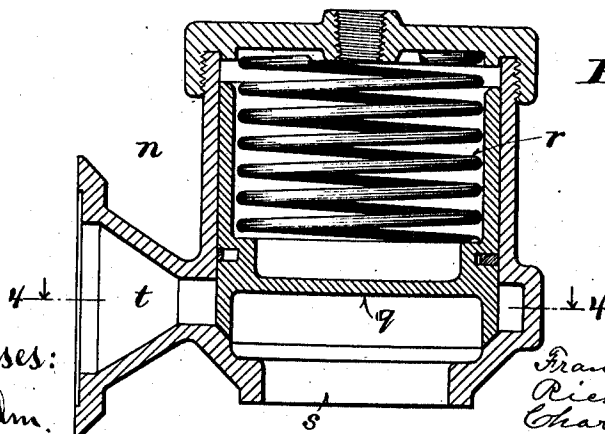


Fig. 5.



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UNITED STATES PATENT OFFICE.

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VACUUM CLEANING APPARATUS.

974,286.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, FRANK J. MATCHETTE, RICHARD RADDATZ, and CHARLES MOUKOS, citizens of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Vacuum Cleaning Apparatus, of which the following is a specification, reference being had to the accompanying drawing, forming a part thereof.

This invention relates to apparatus for removing dust and dirt from carpeted or uncarpeted floors, walls, furniture and other articles by means of a confined current of air. Its main objects are to automatically control the vacuum which produces the air current for operating the cleaning implements; to economize power in the operation of the vacuum producing means, to facilitate manual control of the air current in each cleaning implement and indirectly of the vacuum producing means; and generally to improve the construction and operation of apparatus of this class.

It consists in certain novel features of construction and in the peculiar arrangement and combinations of parts as hereinafter particularly described and pointed out in the claims.

In the accompanying drawing like characters designate the same parts in the several figures.

Figure 1 is a general view principally in elevation, of apparatus embodying the invention; Figs. 2 and 3 are detail views on an enlarged scale of the automatic controller, Fig. 2 being a section on the line 2 2, Fig. 3, and Fig. 3 a section on the line 3 3, Fig. 4, and Figs. 4 and 5 are detail views on an enlarged scale of the unloading valve, Fig. 4 being a section on the line 4 4, Fig. 5, and Fig. 5 a section on the line 5 5, Fig. 4.

For the purpose of illustration the present invention is shown as embodied in a vacuum cleaning apparatus permanently installed in a building, but without material change in its essential features it may be embodied in either stationary or portable apparatus.

Referring to Fig. 1, *a* designates a stand-pipe or service main which when the apparatus is permanently installed in a building is provided at convenient points, as at or near the several floors through which the

pipe passes, with a branch *b* having a stop valve *c* and a hose coupling *d* for the attachment of a portable cleaning implement. A portable cleaning implement *e*, designed as shown in the present case, for removing dust and dirt from floors, carpets and the like, is connected by a flexible pipe or hose *f* with a branch *b* of the service main *a*, and is provided adjacent to its handle within convenient reach of the operator, with a valve *g* for controlling the air passage through the implement. A dust separator or receptacle and low pressure reservoir *h* is ordinarily connected with the lower end of the pipe or main *a*, particularly in apparatus of small or moderate capacity. Where the service pipe system is extensive, it may serve itself as a pressure reservoir, and other provision may be made for disposing of the dust and dirt. A pump *i* is connected on its suction side by a pipe *j* with the receptacle *h*, preferably with the upper part thereof, as shown, and this pipe is provided with a check valve *k* which prevents back flow of air through said pipe from said receptacle when the pump is stopped or unloaded. *l* is the discharge pipe of the pump and *m* designates a motor which may be of any suitable kind for driving the pump.

To maintain the vacuum or low service pressure within desired limits and to economize power, an unloading valve *n* connected with the suction pipe *j* controls communication between the suction side of the pump and the atmosphere. An automatic controller *o* is connected with the chamber of said valve and by a pipe *p* with the dust receptacle and reservoir *h* or with any other convenient part of the apparatus in which service pressure is maintained. In the present case the unloading valve as shown in Fig. 5, has a cylindrical case in which a hollow or cup-shaped piston valve *q* is fitted. A spring *r* holds the valve normally against its seat in the case around the port *s*, which is open to the atmosphere and cuts off communication between said port and the passage *t* which connects with the suction pipe *j* of the pump.

The automatic controller which governs the operation of the unloading valve *q* comprises as shown in Figs. 2 and 3, two piston valves *u* and *v* fitted in a cylindrical chamber which communicates at the ends through a passage *w* with the pipe *p*, and has at an

intermediate point between the two valves one or more ports x opening to the atmosphere. These valves are pressed inwardly toward each other and are normally held by springs z against a pin y passing transversely through the case and forming a stop. The outer ends of these springs bear against flanged followers or seats which are in turn supported upon the points of screws 2 threaded and adjustable axially in the end caps of the valve case. The valve u is formed with longitudinal passages 3 opening through its inner end in communication with the ports x and intersecting at their outer ends an annular groove or passage 4 which registers with a lateral port 5 in the valve case. The valve v is formed with radial passages 6, opening at their inner ends into an axial bore which receives the spring and at their outer ends through the cylindrical face of the valve, and are arranged to register on one side of the valve with a lateral port 7 in the valve case. The ports 5 and 7 are connected by a passage 8, which is in turn connected by a pipe or passage with the chamber of the unloading valve n on the opposite side of the valve q from the port s , as shown in Figs. 1, 2 and 5.

The apparatus operates as follows: The motor being started, the pump i is driven continuously or without interruption as long as the apparatus may be needed. Air is exhausted by the operation of the pump through the pipe j from the dust receptacle and reservoir h and from the standpipe or service main a connected therewith. When the vacuum or pressure at which the controller is adjusted to unload the pump has been reached, the valve u is moved outwardly by the unbalanced air pressure on its inner end against the tension of its spring z , and the groove or passage 4 is carried out of register with the port 5, thereby cutting off communication between the chamber of the unloading valve n and the atmosphere through ports x . The valve v being also moved outwardly by the unbalanced air pressure on its inner end against the tension of its spring z , the passages 6 are brought into register with the port 7, thereby establishing communication between the chamber of the unloading valve and the reservoir h through the passage w and pipe p . When this occurs the unbalanced pressure on the piston valve q compresses the spring r and opens the valve, thereby admitting air into the suction pipe j through the port s and passage t and unloading the pump, which then runs idle. As soon as the vacuum is broken in the pipe j the check valve k is seated, thereby preventing admission of air through said pipe into the reservoir and service main and avoiding the loss of vacuum or pressure and the consequent

waste of power and time which would otherwise occur every time the unloading valve was opened and closed. Whenever the vacuum is reduced or the pressure increased to the limit at which the automatic controller is adjusted to close the unloading valve and bring the pump into service, the valve v pressed inwardly by its spring z , cuts off communication between the unloading valve chamber and the reservoir h , and the valve u pressed inwardly by its spring z , then establishes communication between the atmosphere and the unloading valve chamber through the ports and passages x , 3, 4, 5 and 8. Normal pressure being thereupon restored in the unloading valve chamber, the valve q is instantly closed by the spring r , cutting off communication between the suction pipe j and the atmosphere through the port s . The pump now resumes its work, reducing the pressure in the reservoir h and service main till it again reaches the limit for which the automatic controller is set to open, and the operation of opening the unloading valve and relieving the pump of work is repeated as above explained. The vacuum is thus automatically maintained within the desired limits for which the controller is adjusted without care or attention on the part of the operator, or of any one using a cleaning implement connected with the apparatus.

When a cleaning implement is to be used, the operator opens the handle valve g and dust and dirt are taken up from the carpet, floor or other object over which the implement is moved, by the air current resulting from the opening of said valve, and is carried by such current through the hose connection f into the pipe a and thence into the receptacle h , wherein most if not all of the dust and dirt are separated from the air and settle in the lower part of the receptacle, from which they are removed from time to time through a door at its lower end. The air from which the dust and dirt have been separated, is drawn from the upper part of the receptacle h through the suction pipe j into the pump and discharged therefrom through the pipe l outside of the building in which the apparatus is located or into a smoke stack or other convenient flue or conduit. When work is temporarily discontinued with a cleaning implement for any purpose, such as moving the implement from one place to another or replacing it with another while the pump is running, the valve q is closed, thereby stopping the flow of air through the hose connection into the service main and causing an increase of vacuum or reduction of pressure therein. This increase of vacuum or reduction of pressure operates, as hereinbefore explained, through the automatic controller, to open the valve q and relieve the pump from work, and at the same

time the check valve *h* closes, preventing loss of vacuum and consequent waste of power. During the intervals of time that no work is being done or the apparatus is working at less than its full capacity, as for example, when but one or two cleaning implements are being used in a five implement plant, the unloading valve relieves the pump from duty for longer or shorter intervals according to the demands upon the apparatus. When no work is done, the pump will be brought into service just often enough and just long enough to supply any waste which may occur through leakage in the apparatus and to maintain the vacuum or service pressure within the limits for which the controller is adjusted. It will thus be seen that the effective operation of the pump is governed without care or attention on the part of operators or attendants, by the opening and closing of the valves *g* with which the connections of the cleaning implements are provided, and that the pump will run with or without load and power will be consumed in accordance with the actual demands upon the apparatus, as determined by the manipulation of said valves *g* which control the admission of air into the service main through the cleaning implements.

The receptacle *h* serves not only to collect and hold dust and dirt drawn into the apparatus through the service pipe, but also as a reservoir for the storage of service pressure, whereby unnecessarily frequent operation of the unloading valve is avoided.

The springs *z* and screws 2 of the automatic controller afford means for varying the minimum and maximum pressure limits at which the unloading valve opens and closes. The unloading valve may be connected with the reservoir *h* or with a part of the apparatus in which service pressure is maintained and may be actuated by air pressure, or it may be connected with any other convenient source of power and actuated by such power under the control of the vacuum or service pressure produced by the pump and according to variations in such vacuum or pressure.

Various changes in details of construction and arrangement of parts may be made within the scope of the following claims without departing from the principle of the invention.

We claim:

1. In vacuum cleaning apparatus the combination of a service main, a pump connected therewith and adapted to exhaust air therefrom, an unloading valve controlling communication between the suction side of the pump and the atmosphere and having an actuating connection with a part of the apparatus in which service pressure is maintained, a check valve between said unloading valve and the service main adapted to

prevent back flow of air into said main when the unloading valve is opened, and an automatic controller operated by variations in service pressure to intermittently admit and release such pressure to and from said unloading valve at separate predetermined limits of service pressure, substantially as described.

2. In vacuum cleaning apparatus the combination of a service main, a pump connected therewith and adapted to exhaust air therefrom, an unloading valve controlling communication between the suction side of the pump and the atmosphere and having a fluid pressure actuating connection and an automatic controller connected with a part of the apparatus in which service pressure is maintained and comprising spring pressed valves subjected to service pressure and controlling the admission and release of fluid pressure through the actuating connection of the unloading valve, substantially as described.

3. In vacuum cleaning apparatus the combination of a service main, a pump connected therewith and adapted to exhaust air therefrom, an unloading valve controlling communication between the suction side of the pump and the atmosphere and having a fluid pressure actuating connection, a spring tending to hold said valve closed, and an automatic controller connected with a part of the apparatus in which service pressure is maintained and comprising valves subjected to service pressure and controlling the admission and release of fluid pressure to and from the unloading valve, and adjustable springs opposing the movement of said controller valves by air pressure, substantially as described.

4. In vacuum cleaning apparatus the combination of a dust separator and low pressure reservoir, a pump connected with said separator and reservoir and adapted to exhaust air therefrom, an unloading valve connected with the suction side of said pump and controlling communication between it and the atmosphere, a check valve between said unloading valve and said separator and reservoir adapted to prevent back flow of air into the reservoir when the unloading valve is opened, an automatic controller connected with said reservoir and comprising valve mechanism subjected to service pressure and controlling the operation of the unloading valve and portable means adapted to control the operation of said controller at a distance therefrom, substantially as described.

5. The combination of a service main, a pump connected with said main and adapted to exhaust air therefrom, an unloading valve controlling communication between the suction side of the pump and the atmosphere and having an actuating

connection with a part of the apparatus in which service pressure is maintained, and means adapted to automatically admit and release said service pressure to and from said valve at separate predetermined limits of pressure.

6. The combination of a service main, a pump connected therewith and arranged to exhaust air therefrom, an unloading valve controlling communication between the suction side of the pump and the atmosphere, and an automatic controller comprising valves one of which controls communication between the unloading valve and the atmosphere and the other communication between the unloading valve and a source of fluid pressure, a spring tending to hold one of the controller valves open, and a spring tending to hold the other controller valve closed, substantially as described.

7. The combination of a service main, a pump connected therewith and arranged to exhaust air therefrom, an unloading valve controlling communication between the suction side of the pump and the atmosphere having a fluid pressure actuating connection, a spring tending to hold said valve closed, and an automatic controller connected with a part of the apparatus in which service pressure is maintained and comprising two valves, one of which controls communication between the unloading valve and the atmosphere and the other communication between the unloading valve and the source of pressure which actuates it, springs acting in opposition to the air pressure on said valves, and means for adjusting the tension of said springs to vary the limits of pressure at which the pump will be loaded and unloaded, substantially as described.

8. In vacuum cleaning apparatus the combination of a service main, a pump connected with said main and adapted to exhaust air therefrom, an unloading valve controlling communication between the suction side of the pump and the atmosphere, a check valve between said main and the unloading valve adapted to prevent the back flow of air into said main when the unloading valve is opened, an automatic controller connected with a part of the apparatus in which service pressure is maintained and comprising valve mechanism operated by variations in service pressure and controlling the supply and release of fluid pressure to and from the unloading valve and a portable valve having a flexible connection with the service main for controlling the automatic controller, substantially as described.

9. In vacuum cleaning apparatus the combination of air exhausting means, a valve controlling the operation of said air exhausting means and having an actuating connection, and an automatic controller connected

with a part of the apparatus in which vacuum is maintained and adapted to open and close the actuating connection of said valve at separate predetermined limits of the vacuum to which said controller is subjected.

10. In vacuum cleaning apparatus the combination of air exhausting means, a valve controlling the operation of said air exhausting means and having an actuating connection, an automatic controller connected with a part of the apparatus in which vacuum is maintained and adapted to open and close the actuating connection of said valve at separate predetermined limits of the vacuum to which said controller is subjected and means for adjusting said controller to vary said limits.

11. In vacuum cleaning apparatus the combination of air exhausting means, a valve controlling the operation of said air exhausting means and having an actuating connection, an automatic controller connected with a part of the apparatus in which vacuum is maintained and adapted to open and close the actuating connection of said valve at separate predetermined limits of the vacuum to which said controller is subjected and means for adjusting said controller to vary each of said limits independently of the other.

12. In vacuum cleaning apparatus the combination of air exhausting means, a valve controlling the operation of said air exhausting means and having an actuating connection, and an automatic controller connected with a part of the apparatus in which vacuum is maintained and comprising two separately movable parts subjected to such vacuum and adapted to open and close the actuating connection of said valve at separate predetermined limits of vacuum.

13. In vacuum cleaning apparatus the combination of air exhausting means, a valve controlling the operation of said air exhausting means and having an actuating connection, an automatic controller connected with a part of the apparatus in which vacuum is maintained and comprising two separately movable parts subjected to such vacuum and adapted to open and close the actuating connection of said valve, at separate predetermined limits of vacuum, and means of adjustment for separately varying said limits.

In witness whereof we hereto affix our signatures in presence of two witnesses.

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