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AGITATOR AND FAN DRIVE MECHANISM FOR VACUUM CLEANERS

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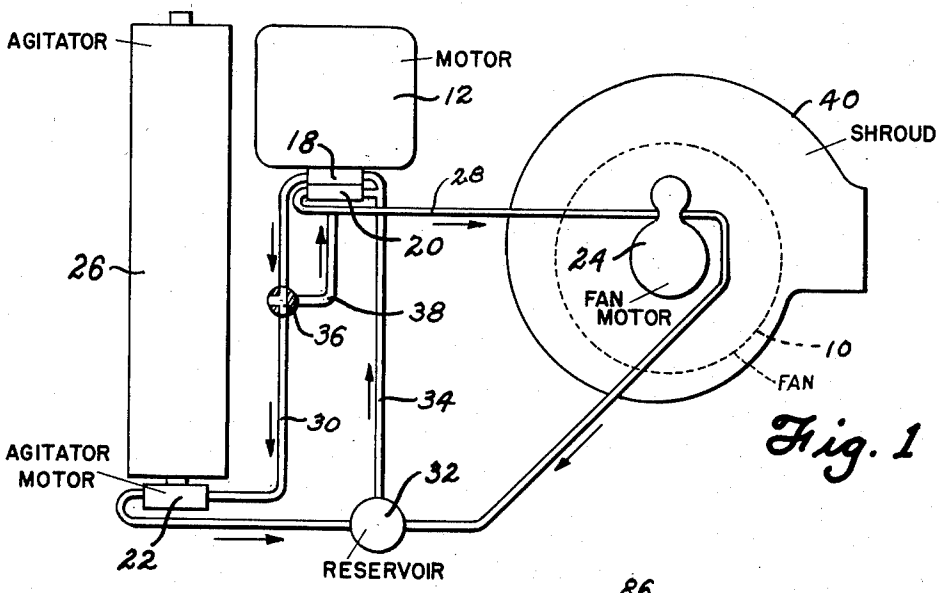


Fig. 1

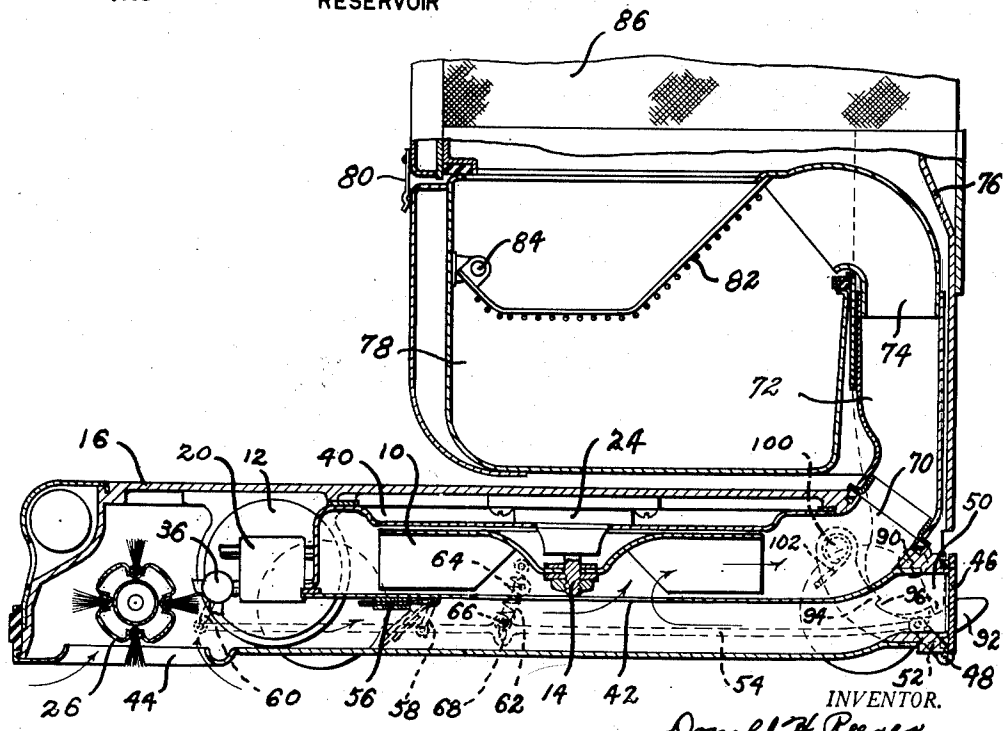


Fig. 2

INVENTOR.
Donald H. Reeves.
BY Spencer, Hardman & Fehr,
His Attorneys.

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AGITATOR AND FAN DRIVE MECHANISM FOR VACUUM CLEANERS

Donald H. Reeves, Dayton, Ohio, assignor to General Motors Corporation, Dayton, Ohio, a corporation of Delaware

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10 Claims. (Cl. 15—377)

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This invention relates to a domestic appliance and more particularly to a vacuum cleaner.

One object of this invention is to provide a more compact and quiet vacuum cleaner having improved cleaning ability.

Another object of this invention is to provide a vacuum cleaner in which a small high speed motor is horizontally disposed within the floor nozzle for driving a large slow speed fan.

Another object of this invention is to provide an improved vacuum cleaner arrangement in which the motor is operated at one speed and in which the fan may be operated at either of two relatively lower speeds.

More particularly, it is an object of this invention to provide a vacuum cleaner in which these speeds are made possible by a hydraulic drive for transmitting power from the motor to the driven elements.

Still another object of this invention is to provide an improved drive for the agitator which eliminates the need for a belt and allows a slower speed of rotation of the agitator.

A further object of this invention is to provide means for operating the fan at an increased speed during off-the-floor cleaning when the agitator is not in operation and when increased fan suction is needed to overcome the friction of the hose.

Another object of this invention is to provide a vacuum cleaner with improved automatic means for changing-over from on the floor cleaning to off-the-floor cleaning.

The desirability of providing a vacuum cleaner with a long nozzle which will go under low furniture has long been recognized and attempts have been made to improve upon the conventional vacuum cleaners in various ways, such as, by mounting the fan and the motor on the handle but in so doing other undesirable features have been introduced, such as, an unbalanced handle and a reduced bag capacity whereas it is an object of this invention to actually increase the bag capacity and improve the balance of the handle at the same time that the height of the nozzle housing is reduced.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a diagrammatic view showing the hydraulic circuit for the fluid drive mechanism; and

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Fig. 2 is a fragmentary sectional view of a vacuum cleaner showing the general arrangement of the various parts.

Referring now to the diagrammatic disclosure in Fig. 1, reference numerals 10 and 12 designate the fan and motor, respectively, which are used for producing the suction. As shown in Fig. 2 of the drawing, the fan shaft 14 is arranged vertically within the floor nozzle housing 16 whereas the motor 12 is arranged so as to have its shaft horizontally disposed within the housing 16. By providing suitable speed reducing means between the motor and the fan, a small motor may be used for driving a large fan. The motor 12 preferably operates at 10,000 to 14,000 R. P. M. and drives a pair of conventional gear pumps 18 and 20 which supply hydraulic fluid under pressure to the hydraulic motors 22 and 24 respectively. The hydraulic motor 22 is arranged to drive the four-brush agitator 26 at slow speed and the hydraulic motor 24 is likewise arranged to drive the fan 10 at a slow speed. The fluid pumped by the pump 20 is delivered to the motor 24 through the line 28 whereas the fluid from the pump 18 is delivered to the motor 22 through the line 30. Reference numeral 32 designates a conventional reservoir into which the fluid returning from the motors 22 and 24 is returned. Reference numeral 34 designates the fluid line leading from the reservoir 32 to the inlets of the pumps 18 and 20 as shown.

Inasmuch as there are times when it is not desired to operate the agitator 26, I have provided an interlocking arrangement whereby the fluid normally supplied to the motor 22 may be added to the fluid supplied to the motor 24 when the agitator 26 is not in operation so as to increase the speed of the fan 10. This interlocking means comprises a 3-way control valve 36 and a line 38 whereby the fluid leaving the pump 18 may be directed either to the motor 22 or the motor 24 merely by operation of the valve 36. It is generally recognized that when a cleaner is used for on-the-floor cleaning purposes, it is not as important to have a high suction as when the cleaner is used with a hose attachment for off-the-floor cleaning purposes. By virtue of the fluid circuit described hereinabove, it is possible to operate the fan at a higher speed for off-the-floor cleaning purposes by adding to the fluid flowing to the fan motor 24 that fluid which would otherwise be used for operating the agitator 26. Another important advantage of the above described drive is that it eliminates the

need for the usual belt which is conventionally required for transmitting power from the motor to the agitator and thereby eliminates the vacant space in the center of the agitator otherwise taken-up by the belt pulley.

As shown in Fig. 2 of the drawings, it is possible to arrange the parts within the nozzle so as to provide a very low nozzle which facilitates cleaning under furniture and the like. The fan 10 is mounted so as to operate within a horizontally disposed shroud 40 arranged as shown. Air enters the shroud 40 through the bottom inlet 42. Whenever the cleaner is used for cleaning carpets and the like, air enters through the usual floor nozzle 44 from whence it flows to the inlet 42 of the shroud 40 as shown by the arrows. When it is desired to use the cleaner with a hose for off-the-floor cleaning purposes, the closure member 46 is swung into the open position about its pivot 48 so as to allow a hose to be connected to the inlet 50. Pivotal movement of the closure 46 operates the lever 52 which is connected to pivot along with the closure 46 about the pivot 48. The free end of the lever 52 operates the rod 54 which is arranged as shown and which in turn operates the damper 56 and the valve 36 through the operating arms 58 and 60 respectively. Thus, when the closure member 46 is moved to the open position, the damper 56 closes-off the connection between the floor nozzle 44 and the fan inlet 42 whereby the fan will suck air from the hose (not shown). Opening of the closure 46 likewise operates the 3-way valve 36 so as to shut-off the flow of fluid to the motor 22 and direct the fluid from the pump 18 through the line 38 which communicates with the line 28 leading to the fan motor 24.

I have provided an over-center spring arrangement for holding the closure 46 in either of its two positions. This arrangement comprises a link 62 and a spring 64 both of which have their upper ends secured to the casing 16 and both of which have their lower ends connected to a pin 66 which operates within the slot 68 provided in the rod 54 as shown. The over-center spring arrangement disclosed herein is shown primarily for purposes of illustration as any other form of holding means may be used for holding the closure member 46 in either the opened position or the closed position.

The dust laden air leaves the shroud 40 through the outlet 70 which fits into a flexible hose section 72 which has its upper end attached to the elbow 74 secured to the handle bracket 76. The outlet end of the elbow 74 discharges into a removable dust receptacle 78 which is held in place by any suitable latching means such as the latching means 80. A screen 82 is pivotally supported within the dust receptacle 78 as at 84 and serves to prevent large objects such as hairpins, strings, lint, pieces of paper and the like from going up into the main dust bag which has been designated by the reference numeral 86 and which is disposed directly above the removable dust receptacle 78. Upon removal of the dust receptacle 78 the screen 82 may be swung upwardly so as to facilitate emptying the receptacle 78. It will be noted that the dust receptacle 78 occupies the space normally required for the fan motor in a conventional type of cleaner and that the weight of the receptacle, plus its contents, helps to balance the handle.

The lower end of the handle bracket 76 is pivoted at 90 and is provided with a substantially arcuate projection for engagement with the handle positioning latch 92. The latch 92 is provided with a notch 94 for engagement with one or more projections such as the projections 96 on the lower end of the bracket 76. The latch 92 is pivoted to swing about the pivot 100 and is held in latching position by means of a torsion spring 102.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. In a suction cleaner, a cleaner body having a nozzle at its forward end, a rotary agitator in said nozzle, a fan chamber connected to said nozzle and arranged rearwardly of said nozzle, a fan in said fan chamber having its shaft arranged substantially vertically, a motor having a substantially horizontal shaft disposed within said cleaner body, a closed hydraulic system including a hydraulic pump means operated by said motor, a fluid motor drivingly connected to said fan shaft, and means for supplying fluid from said hydraulic pump means to said fluid motor, a second fluid motor for operating said agitator, and means for supplying fluid from said hydraulic pump means to said second named motor.

2. In a suction cleaner, a cleaner body having a nozzle, a rotary agitator in said nozzle, a fan in said body for creating a suction, a motor for operating said fan and said agitator, disconnecting means for disconnecting said agitator from said motor, and means interlocked with said disconnecting means for increasing the speed of said fan relative to the speed of said motor upon disconnection of said agitator.

3. In a suction cleaner, a cleaner body having a nozzle at its forward end, a handle pivotally secured to said body at its rearward end, a rotary agitator in said nozzle, a fan chamber within said cleaner body adjacent the rear of said body and having an upwardly directed outlet at the rear of said body, a fan in said fan chamber having its shaft arranged substantially vertically, a motor having a substantially horizontal high speed shaft disposed within said cleaner body between said fan and said agitator, hydraulic pump means operated by said motor, a fluid motor drivingly connected to said fan shaft, a fluid motor drivingly connected to said agitator, and means for supply fluid from said hydraulic pump means to said fluid motors, said agitator, fan, high speed motor and pump means all being mounted approximately in the same generally horizontal plane.

4. In a suction cleaner, a nozzle, an agitator in said nozzle, fan means connected to said nozzle for creating a suction for said nozzle, a prime mover, a closed hydraulic system including a fluid pump means operated by said prime mover, a first fluid motor in driving engagement with said agitator, a second fluid motor in driving engagement with said fan means, means for directing fluid from said pump means to said first and second fluid motors in parallel circuit arrangement, and means for by-passing fluid around one of said fluid motors and for directing said by-passed fluid to the other of said motors.

5. In a suction cleaner, a nozzle, an agitator in said nozzle, fan means connected to said nozzle for creating a suction for said nozzle, a prime mover, a closed hydraulic system including first

and second fluid pumps operated by said prime mover, a first fluid motor in driving engagement with said agitator, a second fluid motor in driving engagement with said fan means, means for directing fluid from said first pump to said first fluid motor, means for directing fluid from said second pump to said second fluid motor, and means for diverting fluid from said first fluid pump to said second fluid motor whereby fluid from both said pumps may be used for operating said second fluid motor a part of the time.

6. In a suction cleaner, a casing having a nozzle opening at its forward end, an agitator within said casing and disposed adjacent said nozzle opening, a motor, a suction fan having its inlet communicating with said casing, power transmitting means between said motor and said agitator and said fan, said power transmitting means including control means for disengaging said agitator from said motor and simultaneously varying the speed ratio between said motor and said fan.

7. In a suction cleaner, a casing, suction creating means for creating a suction within said casing, an agitator within said casing, a motor, power transmitting means between said motor and said agitator and said suction creating means, said power transmitting means including speed changing and control means for operating said fan at either of two speeds and having means interlocked therewith for disengaging said agitator from said motor when said fan is operating at one of said speeds.

8. In a suction cleaner, a cleaner body having a nozzle and a fan chamber connected to the nozzle, a motor mounted upon said cleaner body, fan means in said fan chamber for drawing fluid from said nozzle, agitating means located in said nozzle, a closed hydraulic system including a multiple element pump having a plurality of individual pumping chambers with individual outlets driven by said motor, said system including a first hydraulic motor for driving said fan means having its inlet connected to one outlet of said pump, said system including a second hydraulic motor for driving said agitating means having its inlet connected to a second outlet of said pump.

9. In a suction cleaner, a cleaner body having a nozzle and a fan chamber connected to the nozzle, a motor mounted upon said cleaner body, fan means in said fan chamber for drawing fluid from said nozzle, agitating means located in said nozzle, a closed hydraulic system including a multiple element pump having a plurality of individual pumping chambers with individual outlets driven by said motor, said system including a first hydraulic motor for driving said fan means having its inlet connected to one outlet of said pump, said system including a second hydraulic motor for driving said agitating means having its inlet connected to a second outlet of said pump, and means for connecting the second outlet of said pump to the inlet of the first hydraulic motor

driving the fan for increasing the speed of the fan.

10. In a suction cleaner, a cleaner body having a nozzle and a fan chamber connected to the nozzle, a motor mounted upon said cleaner body, fan means in said fan chamber for drawing fluid from said nozzle, agitating means located in said nozzle, a closed hydraulic system including a multiple element pump having a plurality of individual pumping chambers with individual outlets driven by said motor, said system including a first hydraulic motor for driving said fan means having its inlet connected to one outlet of said pump, said system including a second hydraulic motor for driving said agitating means having its inlet connected to a second outlet of said pump, a three-way valve in the connection between the second outlet and the inlet of said second hydraulic motor, a hydraulic connection between said three-way valve and the inlet of the first hydraulic motor for diverting the output from the second outlet to the first hydraulic motor.

DONALD H. REEVES.

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