

Nov. 25, 1930.

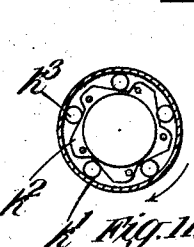
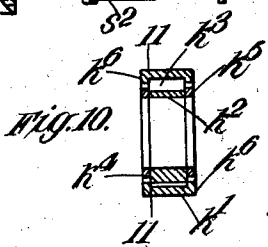
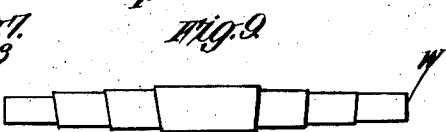
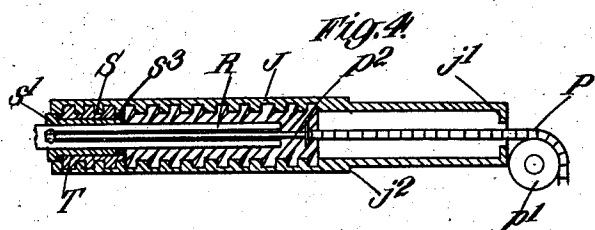
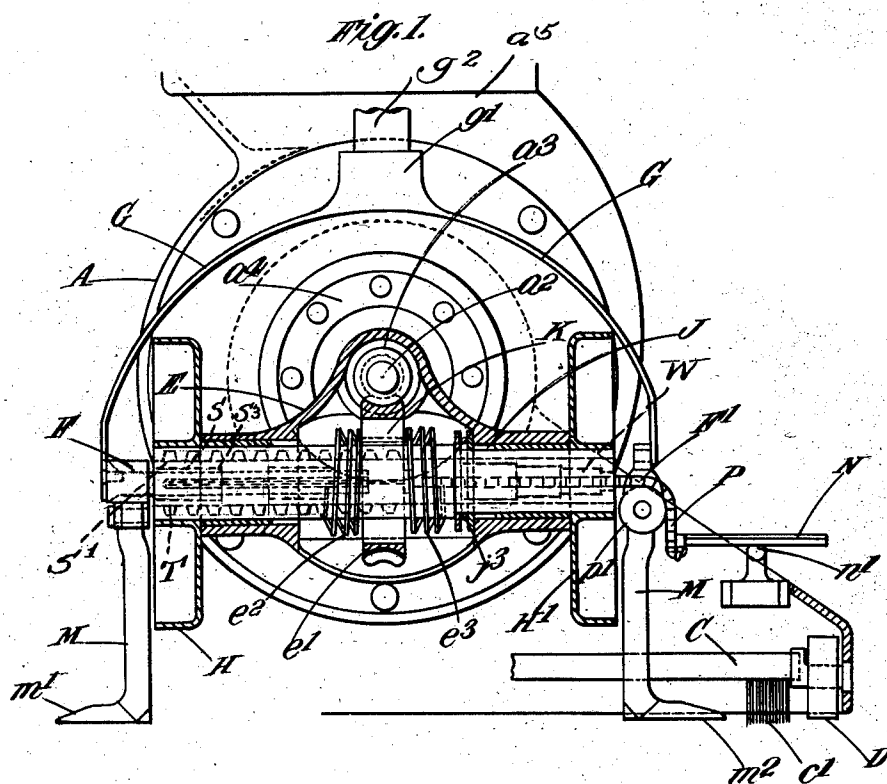
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VACUUM CLEANER

Filed March 4, 1927

4 Sheets-Sheet 1



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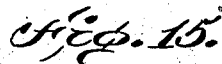
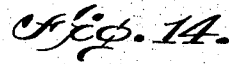
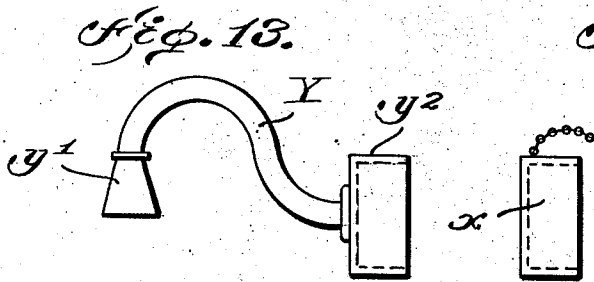
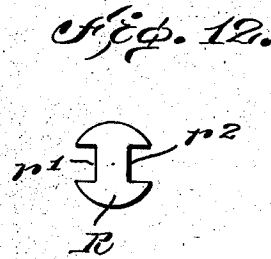
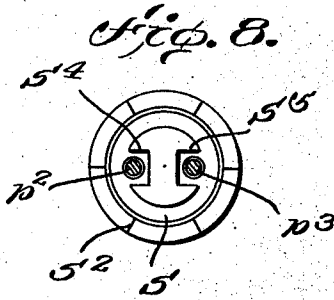
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4 Sheets-Sheet 3



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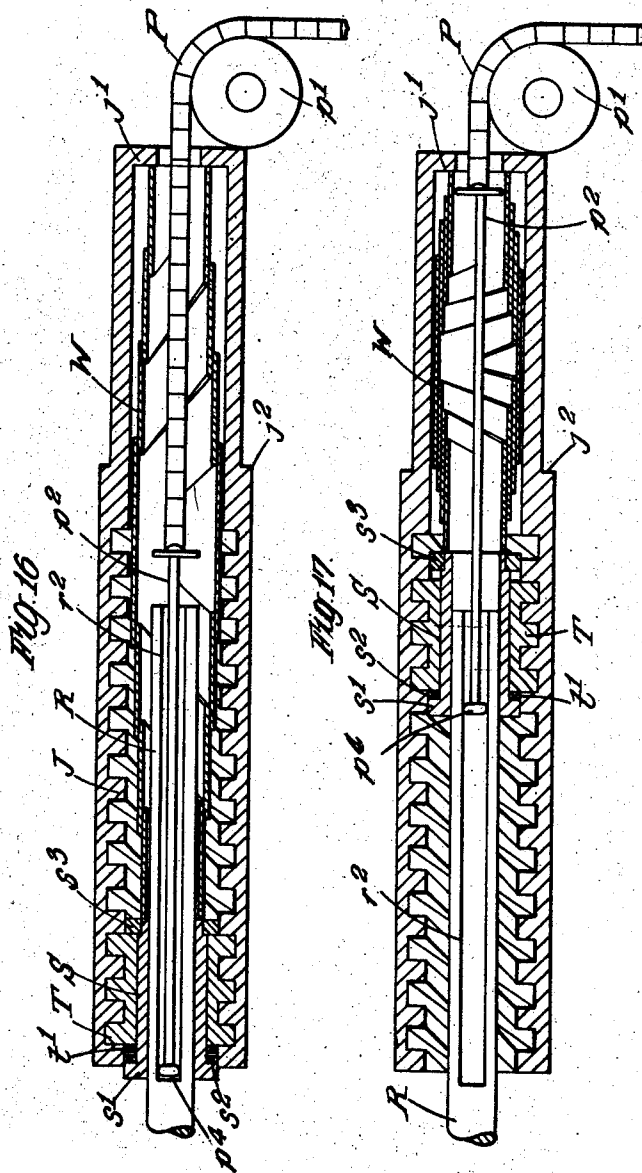
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VACUUM CLEANER

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UNITED STATES PATENT OFFICE

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VACUUM CLEANER

Application filed March 4, 1927, Serial No. 172,719, and in Great Britain April 29, 1926.

This invention relates to vacuum cleaners or suction sweeping machines of the kind in which the operation of the gear for actuating the fan or equivalent device for inducing the suctional air current is dependent on the revolution of the floor wheels on which the machine travels.

In such machines wherein the suction device is of the bellows type, the opening and closing movements of the bellows can be effected by moving the machine forward and backward, but in machines employing a rotary fan for suction, a clutch of the free wheel type adapted to transmit a drive in one direction only has been arranged between the floor wheels and the fan shaft to prevent reversal of the rotation of the fan shaft being caused by reciprocation of the machine. It is desirable in such machines that the suction device should be capable of operating while the drive obtained by friction between the wheels and the floor is suspended, so that cleaning can be carried out in corners and other places where rapid movements of the whole machine on the floor are not practicable, and also that the machine can be used for cleaning curtains or upholstery while it is stationary, the suction being in the latter case performed with the aid of a flexible tube instead of by the usual floor nozzle; and in machines fitted with bellows it has been proposed to provide means for lifting the wheels off the floor while the bellows were operated by levers or by a small winch handle, or by rocking the long steering handle.

According to this invention a plunger contained in a tubular axle is adapted to be drawn in one direction by a flexible cable and returned by a spring, this plunger being screw threaded and engaging a corresponding internal screw thread formed inside the axle, and a clutch preventing rotation of the plunger in its operative stroke so that the axle is caused to rotate, while on its return stroke the plunger rotates idly without transmitting movement to the axle. The axle is surrounded by a coiled spring secured at one end to the axle and at the other end to a free wheel clutch adapted to transmit a drive in one direction only to the rotary shaft of the

suction fan. The free wheel clutch comprises a casing connected by worm or other gearing with the fan shaft, an annular member such as a ring or disc provided with recesses in which a number of intermediate rolling members (say five) can nestle out of driving engagement with the said casing during rotation of the hollow axle in one direction, and with tangential or volute surfaces between which and the casing the said rolling members are gripped so as to transmit a drive during rotation of the said axle in the opposite direction, the rolling members being enclosed between flanges formed on the casing, and washers or plates surrounding the axle and secured to the disc or ring by screws or the like, the said washers or plates thus serving as retaining members for the rolling members, which in turn hold the outer casing from floating.

In order that the said invention may be clearly understood and readily carried into effect, the same will now be described more fully with reference to the accompanying drawings, wherein:—

Figure 1 is a rear elevation of a vacuum cleaner embodying this invention, partly in section on the line 1—1 in Figure 3.

Figure 2 is a plan of a portion of the machine.

Figure 3 represents portions of the machine in vertical section taken on the line 3—3 in Figure 2.

Figure 4 represents in longitudinal section a hollow axle and parts associated therewith.

Figure 5 is an elevation of a sleeve or plunger adapted to work within the hollow axle represented in Figure 4.

Figures 6 and 7 represent in side elevation component parts of an inner sleeve, and Figure 8 is an end elevation of the said inner sleeve on an enlarged scale and associated with wires in section.

Figure 9 is a side elevation of a spring adapted to be confined within the said hollow axle.

Figure 10 is a central vertical cross section of a clutch device.

Figure 11 is a section of the said free wheel device taken on the line 11—11 in Figure 10.

Figures 12 to 15 represent details herein-after referred to.

Figures 16 and 17 represent details herein-after referred to.

5 A indicates the body or fan casing of the machine, containing a suction fan a^1 of any suitable kind rotatable with the worm shaft a^2 . In a forward extension B of the fan casing are two inlet nozzles b^1 and b^2 , (Figure 3) 10 the former of these, which may be circular, being adapted for the connection thereto of a flexible tube y , Figure 13 and covered by a detachable cap x , Figure 14, when such tube is not in use, the said cap being preferably 15 secured to the extension B by a chain x^1 in order to prevent its being lost. The lower nozzle b^2 , which extends across the front of the machine, is traversed longitudinally by a rod or bar C on which is fixed a brush c^1 , and 20 within the ends of the said nozzle b^2 are rollers D adapted to support the front of the machine when travelling along the floor. In the extension B is rotatably mounted a barrel or hollow valve b^3 , the neck of which extends 25 through the nozzle b^1 , and is provided with a pin or other projection b^4 working in a slot b^5 in the top of the extension B, by moving which pin in one direction an open part of the wall of the barrel b^3 can be brought opposite 30 the nozzle b^2 to establish a communication between the said nozzle and the interior of the fan casing A, the nozzle b^1 being then closed by the aforesaid cap. By moving the pin b^4 in the reverse direction, a closed part of the 35 wall of the barrel b^3 is caused to cut off the communication between the parts A and b^2 . The machine can thus be used with a flexible tube when stationary, and either with a flexible tube or with utilization of the downwardly 40 directed nozzle b^2 when in motion. A bag Z, Figure 15 or other receptacle for dust can be secured over the open top a^5 of the fan casing A. On the back plate a^4 of this casing are secured the gear box E and two angle 45 brackets F, F^1 , these brackets carrying bearings in which is pivoted a curved bar or strip G forming at its apex a ring g^1 for receiving the end of a stick or other handle g^2 by which the machine can be guided and propelled over 50 the floor. The rear or main floor wheels H, H^1 of the machine, which are preferably rubber-tyred, are carried on a hollow axle J mounted in the gear box E, which axle J is adapted to transmit through a clutch device K 55 a rotary movement in one direction only to a worm wheel e^1 in gear with the worm a^3 on the fan shaft a^2 .

The machine when stationary may be placed on a stand M having feet m^1 , m^2 , the 60 brackets F, F^1 resting on the said stand, which may be an ordinary motor-cycle stand, so that the wheels H, H^1 are clear of the floor and free to rotate. A pedal N on the end of a rod n^1 hinged to the back of the extension B, 65 or to any other convenient part of the ma-

chine, is connected with a chain P passing over a roller p^1 mounted in the bracket F^1 . This chain is connected with two wires p^2 , p^3 (Figures 4 and 8) passing through diametrically opposite grooves r^1 , r^2 in a rod R 70 fixed to the bracket F, the said two wires being connected with a sleeve S capable of longitudinal movement along the said rod R but having ribs s^4 , s^5 (Figures 6 and 8) entering the said grooves to prevent its rotation. The said wires pass through longitudinal 75 holes drilled in the ribs of the sleeve S and are provided with balled ends p^4 engaging the rear surface of the said sleeve. This sleeve S is fitted inside another sleeve or 80 plunger T (Figure 5) the latter being externally screw-threaded to engage an internal screw thread formed in the hollow axle J (see Figure 4). The sleeve T has rack teeth t^1 85 formed thereon, and the sleeve S has a flange s^1 provided with oppositely arranged clutch teeth s^2 (Figures 6 and 8) adapted to mesh with the said teeth t^1 in one direction. Figures 16 and 17 clearly illustrate the parts J, 90 S, R, T, P, and W, in two positions. Figure 16 represents these parts in the position of rest, in which the spring W is fully expanded and has pressed back the ring s^3 and sleeve S so far to the left that the teeth s^2 are 95 clear of the teeth t^1 . Figure 17 represents the same parts at the completion of the operative stroke, in which by traction on the chain P acting through the wires p^2 , p^3 the sleeve S has first been drawn to the right against the 100 resistance of the spring W to engage the teeth s^1 with the teeth t^1 and thereby to prevent rotation of the plunger T, leaving a small clearance between the right hand end of the plunger T and the ring s^3 , and as the traction 105 continues and the plunger T advances to the end of its stroke, that is, to the position seen in Figure 17, without rotating, its screw thread engaging the internal screw thread on the hollow axle J causes rotation of the said hollow axle, and thereby of the fan. On the 110 removal of pressure from the pedal N, the spring W is free to expand, pressing back the ring s^3 and sleeve S to disengage the teeth s^1 from the teeth t^1 so that on the return stroke of the plunger T, under the 115 impulse of the spring W, which continues to press against the ring s^3 now in contact with the front of the plunger T, the said plunger is free to perform the rotation imposed on it by the internal screw thread of 120 the axle J, and does rotate while returning, so that it does not rotate the axle J to reverse the rotation of the fan, because it has no power to overcome the inertia or resistance to such reversal of the fan and axle J. To prevent 125 detachment of the sleeves S and T from each other after they have been assembled, a ring s^3 (Figure 7) is riveted or otherwise secured on the right hand end of the sleeve S, which however permits relative lon- 130

gitudinal movement between the sleeves S and T so that the clutch teeth can be set free from each other to allow a rotary movement of the sleeve T. A double involute spring W is disposed inside the hollow axle J in compression between the ring s^3 and the flange j^1 on the axle.

The free wheel device indicated generally by the reference letter K in Figure 1 comprises a casing k^1 (Figures 10 and 11) secured in any suitable manner to the inside of the worm wheel e^1 , an annular member k^2 suitably secured to the hollow axle j , for example by springs e^2 , e^3 (Figure 1) a series of rollers k^3 between the said parts k^1 and k^2 , and washers k^4 and k^5 secured to the said annular member k^2 , the flanges k^6 of the casing k^1 co-operating with the said washers to retain the rollers within the casing. The right hand end of the hollow axle J is made of reduced diameter to form a shoulder j^2 (Figure 4) against which abuts a ball race j^3 (Figure 1) to take the thrust of the pedal movement. The flexible tube Y is provided with a nozzle y^1 and with a cap y^2 for attachment to the nozzle b^1 .

When the pedal N is depressed to exert traction on the chain P and wires p^2 ; p^3 , the latter cause the sleeve S to slide on the rod R and the teeth s^2 to engage the teeth t^1 , the sleeve T is constrained to follow this movement towards the right hand side (viewing Figure 1) without rotating and its screw thread thereby causes rotation of the hollow axle J and of the annular member k^2 thereon in the direction of the arrow seen in Figure 11, so that the rollers k^3 are gripped between the said annular member and the casing k^1 and transmit rotary movement to the said casing, and thereby to the worm wheel e^1 , worm a^3 and fan shaft a^2 . In this longitudinal movement of the sleeve S the spring W is compressed, and on removal of pressure from the pedal N the spring W again expands longitudinally, pressing back the sleeve S and returning the parts to the positions in which they are represented in the drawings, the rollers k^3 however nestling in the recesses in the annular member k^2 and ceasing to transmit any movement to the casing k^1 , so that the rotation of the fan shaft a^2 is not reversed. At the same time the sleeve S overruns the sleeve T so that the teeth s^2 and t^1 are disengaged and the sleeve T revolves idly in its return stroke, in order to avoid waste of power by turning in the reverse direction the wheels H, H^1 which have necessarily participated in the operative revolution of the hollow shaft J. This arrangement of the rack teeth also provides a double safeguard against reversal of the fan shaft, because it practically prevents rotation of the hollow axle during the upstroke of the pedal, while the free wheel device K prevents further transmission of such rota-

tion in the event of its accidentally occurring. Furthermore, the machine can be lifted off the stand and put in action on the floor without the necessity of releasing any catch in the pedal movement, because the spring W when expanded keeps the teeth of the two sleeves out of mesh with each other, so that the hollow axle and the wheels H, H^1 can turn in either direction when the machine is moved backwards and forwards on the floor, although the forward stroke of the machine is the only one which operates the fan.

What we claim and desire to secure by Letters Patent of the United States is:—

1. In a vacuum cleaner, a stand, a casing adapted to rest on said stand and having an outlet, an inlet communicating with the interior of said casing, a rotatable shaft, a suction fan secured on said shaft and adapted to be revolved thereby in said casing, an internally screw threaded tubular axle geared to said shaft, an externally screw threaded plunger within said axle, a pedal, a flexible connection between said pedal and said plunger adapted to draw said plunger longitudinally and thereby rotate said axle, means to prevent rotation of said plunger in said operative movement, and means to return said plunger inoperatively.

2. In a vacuum cleaner, a stand, a casing adapted to rest on said stand and having an outlet, an inlet nozzle communicating with the interior of said casing, a rotatable shaft, a suction fan secured on said shaft and adapted to be revolved thereby in said casing, an internally screw threaded tubular axle geared to said shaft, an externally screw threaded hollow plunger within said axle having clutch teeth, a non-rotatry sleeve within said plunger also provided with clutch teeth adapted to mesh with the teeth on said plunger and thereby prevent rotation of said plunger, a pedal, a flexible connection between said pedal and said sleeve adapted to draw said sleeve and thereby said plunger longitudinally to rotate said axle and a spring confined within said axle and tending to return said sleeve and plunger with disengagement of the respective clutch teeth thereon, to permit rotation of said plunger on its return stroke.

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