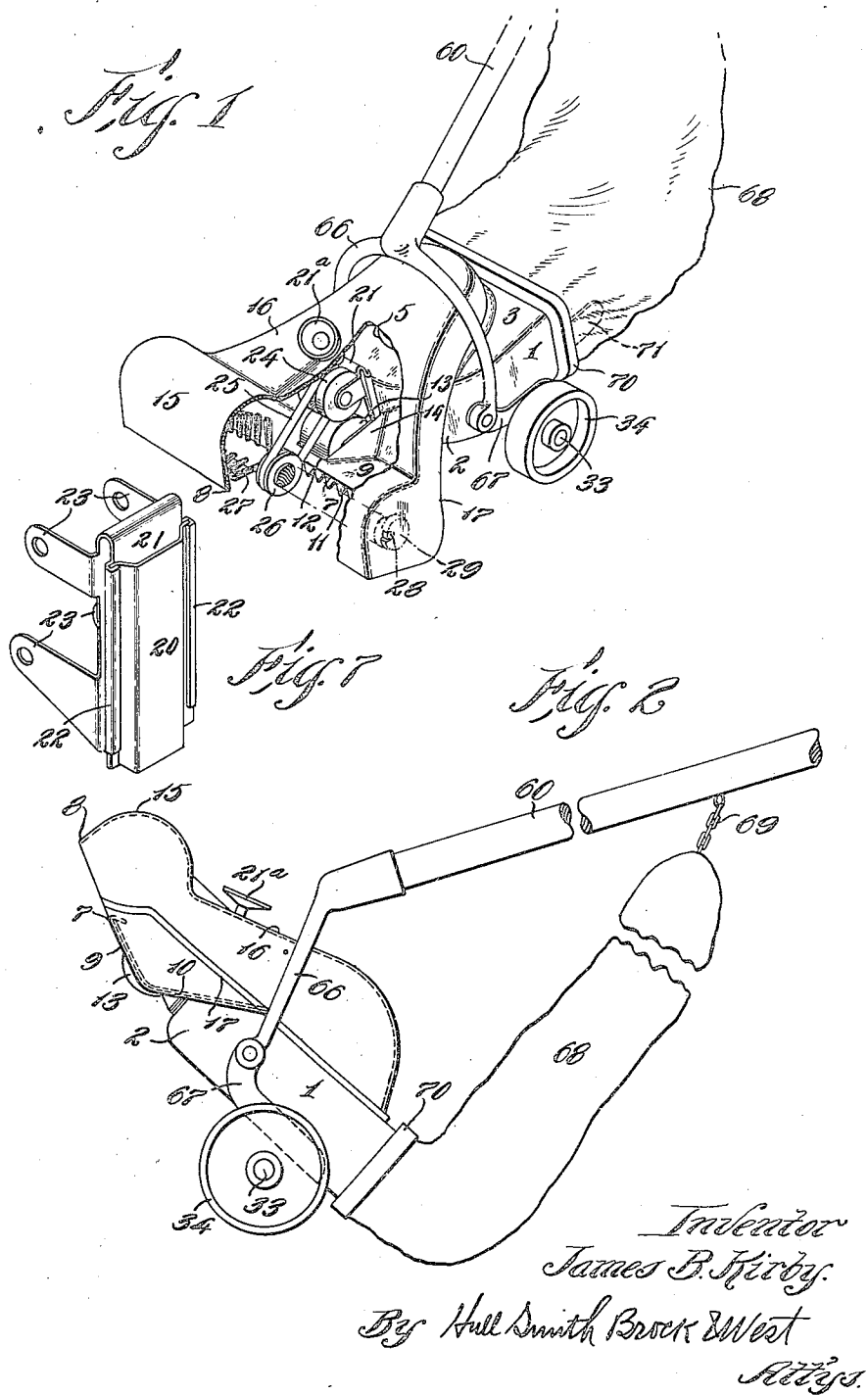


J. B. KIRBY.
 SUCTION SWEEPER.
 APPLICATION FILED APR. 12, 1919.

1,421,958.

Patented July 4, 1922.
 3 SHEETS—SHEET 1.



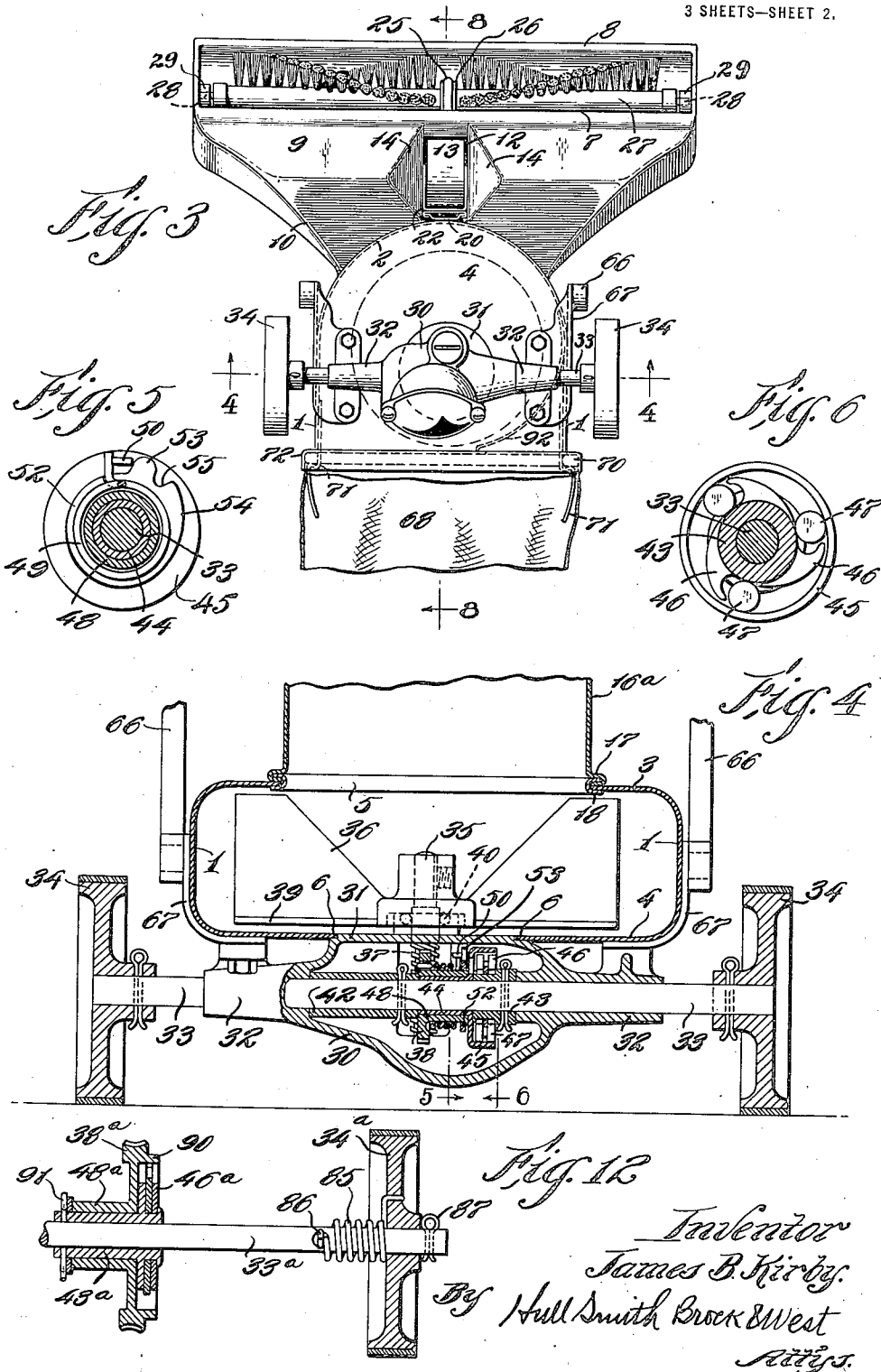
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Fig. 8

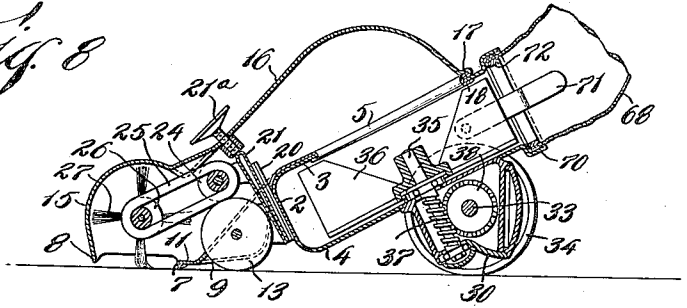


Fig. 9

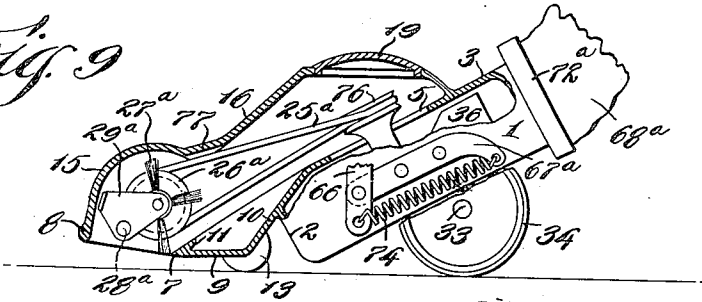


Fig. 10

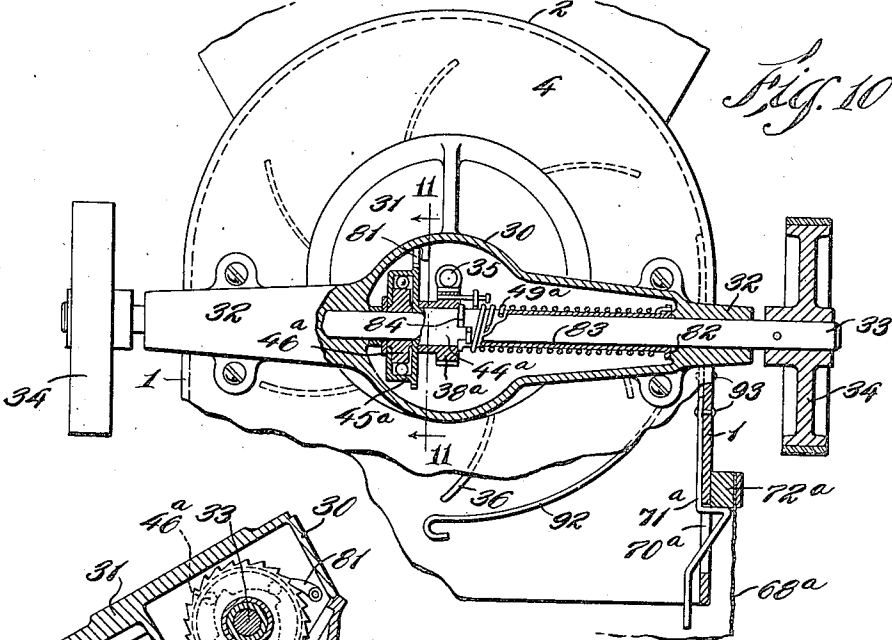
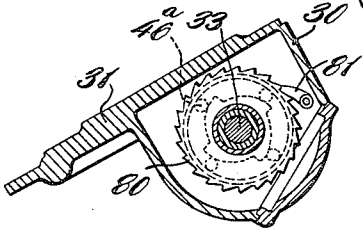


Fig. 11



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UNITED STATES PATENT OFFICE.

JAMES B. KIRBY, OF CLEVELAND, OHIO.

SUCTION SWEEPER.

1,421,958.

Specification of Letters Patent.

Patented July 4, 1922.

Application filed April 12, 1919. Serial No. 289,617.

To all whom it may concern:

Be it known that I, JAMES B. KIRBY, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Suction Sweepers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

The object of this invention is the provision of an improved device for sweeping, brushing, and cleaning floors and floor coverings without the expense which attends an electrically operated cleaning device, or the inconvenience which attends its use. My improved cleaner is operated by the same movement which propels it across the floor or carpet, while provision is made for sweeping and agitating the surface over which it passes and for sucking up the dust so produced, the arrangement being such that the suction device operates continuously for a considerable time even though the machine be stationary, and a yielding driving connection being employed so as to facilitate the starting of the machine from rest and to maintain a more uniform suction.

In the drawings accompanying and forming a part of this application, I have shown certain representative embodiments of my invention. Fig. 1 is a perspective view of one of the preferred forms of my cleaner with a part of the brush-casing or nozzle broken away; Fig. 2 is a side view of the cleaner illustrating the position it assumes when raised from the floor; Fig. 3 is a bottom-plan view of said cleaner; Fig. 4 is a transverse sectional view on the line 4—4 of Fig. 3; Figs 5 and 6 are detail sectional views corresponding to the lines 5—5 and 6—6 respectively of Fig. 4; Fig. 7 is a perspective view of the forward roller-bracket; Fig. 8 is a longitudinal sectional view on the line 8—8 of Figs. 3 and 4; Fig. 9 represents a side-elevation, partly in section, of a modified form of cleaner embodying my invention; Fig. 10 represents an enlarged bottom plan view of the device shown in Fig. 9, the operating mechanism being shown in section; Fig. 11 is a detail sectional view taken on the line 11—11 of Fig. 10; and Fig. 12 illustrates a modified form of driving mechanism.

The cleaner as a whole comprises a casing, a handle, and a dust-bag, while the casing in its preferred form comprises essentially

a fan chamber and nozzle. This fan chamber preferably has a U-shaped side wall comprising a pair of straight portions 1—1 connected together by a curved portion 2, the margins of said side wall being connected by flat walls 3 and 4 respectively. This forms a pocket-shaped chamber having its square end open as shown in Figs. 3, 8 and 10, in addition to which the sides 3 and 4 are formed with openings 5 and 6 respectively. This fan chamber is normally supported with its flat walls oblique to the horizontal, its aperture 5 uppermost, and its open end disposed at its highest point, while the curved end 2 projects nearly to the floor upon which the device rests.

The collecting nozzle over-laps the top of said chamber and is preferably of a flaring or fan shape, its narrowest part surrounding and enclosing the opening 5 and its body broadening with increasing distance from said opening to its forward extremity, where it projects beyond the limits of said fan chamber and is formed with a downwardly facing inlet-mouth defined by the parallel horizontal lips 7 and 8. From the lip 7 the bottom wall of the nozzle first extends rearwardly for a short distance as shown at 9 at a comparatively small inclination to the horizontal so as to form a receiving ledge or dust pan, and thence extends more steeply upwardly as shown at 10 until it reaches the top wall of the fan chamber. The forward margin of this ledge or dust-pan is formed above the lip 7 with a series of upwardly projecting sharp teeth 11 close to the bristles and arranged to remove lint, etc., therefrom during the backward running of the brush and also to retain heavy litter on the dust pan. Also I have shown the wall 9 as interrupted at its central point by a slot 12 formed for the accommodation of the supporting roller 13. At each side of this slot I have shown an inclined cheek 14 which joins the bottom wall 9 and inclined wall 10.

From the lip 8 there rises a cylindrical wall 15 defining a brush chamber and merging with the top wall 16 of the nozzle which covers and embraces the opening 5. The parts hitherto described can be made either from cast metal or from sheet metal. The devices shown in Figs. 1 to 8 inclusive are made of sheet metal, the fan chamber being formed from a single piece of metal by drawing in suitable dies, and the nozzle be-

ing similarly formed from two pieces of metal, one of which forms the top and visible portion and the other the bottom or hidden portion. These two parts are joined by an interlocked seam 17 which follows the edge of the dust pan clear to and around the opening 5 (see Figs. 2 and 4), while the bottom or hidden portion is formed with a neck 18 which is inserted into the aperture 5 and spun over to hold the two members together. In Figs. 9 and 10 I have shown the casing as made of cast metal in one piece, and in this embodiment I have also shown the top wall of the nozzle-part as provided with a removable portion 19.

Referring now to Figs. 1 to 8 inclusive, I have shown attached to the wall 2 of the fan chamber inside the notch 12 an upright guide 20 having mounted thereon the slide 21 here made from a single piece of sheet metal folded upon itself, one of its plies having the inturned edges 22 which engage the guide 20 and the other having two pairs of brackets 23. Between the lower brackets the roller 13 is journaled and between the upper brackets there is journaled a second roller 24 having therein a deep groove receiving the elastic belt 25 which encircles that roller and also encircles the pulley 26 of a suitable brush 27. The relative position of the rollers 13 and 24 is such that the rotation of the roller 13 imparts motion to the belt 25 and thus to the brush; this may be effected either by having the faces of the rollers directly in contact or by having the belt 26 pass by the roller 13 in contacting relation. Each end of the brush shaft is provided with a bearing pin 28 which engages in suitable manner a bearing member 29 carried by the nozzle interior which is here shown as consisting merely of a wooden plug having a radial notch, the wood being employed because it will operate without lubrication and the notch being turned in the opposite direction from the roller 24 so that the brush will be held in place by the elasticity of the belt 25. The slide 21 is adjusted by means of a set screw 21^a.

Secured to the bottom plate 4 is a motor casing having a hollow body portion 30 formed with a flat side 31 which closes the aperture 6, and also having aligned horizontal arms 32 which constitute bearings for the carrying shaft 33 which traverses the same from end to end in a direction parallel to the lips 7 and 8. Rigidly secured to the outer end of this shaft are the carrying wheels 34—34 which in conjunction with the roller 13 support the casing in the inclined position heretofore described, these wheels being preferably rubber tired for traction purposes as well as to prevent marring of polished floors. Journaled in said casing, perpendicular to the wall 4, is a fan shaft 35 to the upper end of which is removably

secured a rotatable fan 36 and whose lower end is formed adjacent to the shaft 33 with a worm screw 37. Surrounding the shaft 33 is a worm gear 38 which meshes with the worm screw 37. The fan is preferably made with a solid circular back 39 adjacent the wall 4 both for the purpose of increasing its momentum or fly-wheel effect and to decrease the likelihood of its obstruction. The hub of the fan is preferably made hollow for the reception of the ball bearing 40.

In order to avoid an unpleasant degree of resistance to the starting of the cleaner caused by this momentum, certain of the wheels with which the shaft 23 is provided are flexibly attached thereto so as to constitute a species of spring-motor, storing up energy while the casing is moving forwardly at a speed greater than that of the fan and yielding up that energy when said casing is stopped or drawn rearwardly or even advanced at a rate below that of the fan motion. In the embodiments illustrated in Figs. 4 to 8, the wheels 34 are attached rigidly to the shaft and the wheel 38 flexibly attached in the following manner: loosely journaled upon the shaft between fixed collars 42—43 is a sleeve 44 having at one end the cylindrical enlargement 45. Inside this enlargement the collar 43 is provided with cam-shaped ears 46 between which and the enlargement are confined the rollers 47 of a silent ratchet or one-way clutch. The gear 38 is formed with a cylindrical hub 48 journaled upon the outside of the sleeve 44 and also held in place by the collar 42; the gear 38 and enlargement 45 being connected together by a helical spring 49, one end of which projects through a hole in the gear and the opposite end of which is hooked to a finger 50 carried by said enlargement, the direction of winding of the spring and the direction of the clutch cams being such that when the machine is run forward the clutch will engage and upon such engagement will twist the spring in a direction to tighten the same and thereby tend to rotate the gear 38. This operation is particularly important when starting the device from rest, and sufficient spring capacity is preferably provided to permit the rotation of the wheels 34 at least about one half a revolution which corresponds to several revolutions of the fan.

In order to prevent the machine from being rendered inoperative by the accidental breaking of the spring I have provided the expedients shown particularly in Fig. 5 and comprising a metal washer 52 rigidly affixed to the hub 48 between the spring and the enlargement 45 and having an outstanding finger 53 engaging the finger 50 at the opposite side from the end of the spring. Upon the opposite side of the finger 53 from the finger 50 the edge of the washer is given a

cam shape as shown at 54, so as to become wedged against the finger 50 in case the spring should break and allow the parts to turn so far, thus locking the two members immovably together. I have also shown this washer as formed beyond the cam portion 54 with a notch 55 in which the tongue 50 could spring if it ever moved that far and be positively held against displacement.

It will be seen that the shaft 35 defines and constitutes the axis of the motor and also coincides with the axis of the fan, such common axis being downwardly and rearwardly inclined. It will also be clear that I do not restrict myself to this kind or type of motor.

The device is operated by means of a handle 60 provided with a fork 66 whose arms depend one on each side of the cleaner and are pivoted to suitable brackets 67 which may be either bolted to the arms 32—32 as shown in Figs. 1 to 4 inclusive or affixed to the side of the cleaner as shown at 67^a in Fig. 9. Tightly secured to the open end of the fan chamber is the mouth of a porous bag 68 whose opposite end is suitably attached to the handle as shown at 69. In the embodiment shown in Figs. 1—8 inclusive the open end of the fan chamber is enlarged to produce a rectangular recess 70 and is formed with internal spring fingers 71—71, one at each side, which overhang the base of the recess and have shoulders adapted to engage a suitable stiffening flange 72 with which the lower end of the bag is provided. In the embodiment shown in Figs. 9 and 10 the recess 70 is omitted, the hooks 71^a having teeth which project through apertures 70^a formed in the side 1—1 of the fan chamber, and the bag 68^a has a frame 72^a which embraces the end of the fan chamber and is engaged by the hooks. These hooks are disengaged by pressing inwardly against the bag fabric. The device is so arranged that when elevated from the floor by lifting with the handle 60, it will become tilted rearwardly to the position shown in Fig. 2 so that any refuse lying upon the dust pan and not already swept into the suction chamber by the air stream will be dumped thereinto from which it will pass to the bag. In the present embodiment this action is assisted by the fan, but would still occur even in the absence of the same. This inclination can be effected either by attaching the handle sufficiently forward from the center of gravity or by assisting the gravitational action by means of spiral spring as shown at 74 in Fig. 9.

In Figs. 9—11 inclusive I have shown a modified spring motor and brush drive. The brush 27^a is provided at its middle point with a pulley 26^a connected by means of a belt 25^a with a pulley 76 carried by the end of the fan shaft and projecting through the aperture 5. This necessitates a quarter-turn of the belt, and the same is arranged

with its power-run lowermost as shown in Fig. 9 so as always to sweep refuse towards the dust pan. The cover 19 permits access to the interior of the nozzle to apply this belt, and the nozzle wall is conveniently provided with a notch as at 77 which shall prevent the belt from being applied in incorrect position. I have also shown this brush as journaled to brackets 29^a each of which is pivoted at 28^a, so that in case the rotation of the brush were arrested or resisted, the increased tension upon the lower part of the belt would tend to elevate the brush and thus cause it to clear the obstruction. In this case the brush runs at high speed, the same as the fan, and by being belted to the fan is driven for a long time and is particularly useful for bare floors (such as barber shops).

In case the brush is to be driven from the carrying wheels, either with or independently of the fan, the same spring arrangement may be employed as before, but it is sometimes well to employ a spring-motor of larger winding capacity, for example that shown in Figs. 10 and 11. In this case the shaft is provided with a loose sleeve 44^a having at one end the enlargement 45^a similarly housing a ball or roller clutch as shown generally at 46^a, but the exterior of the enlargement is provided with ratchet teeth 80 co-operating with a pawl 81 carried by the housing. Journaled upon the exterior of the sleeve 44^a is the worm gear 38^a which is connected by means of the spring 49^a with the flange 82 upon the opposite end of an elongated sleeve 83, whose nearer end is interlinked with the sleeve 44^a by means of the teeth 84. Upon the forward movement of the cleaner, the enlargement 45^a is advanced by the friction clutch in a direction to wind the spring 49^a, and its return is prevented by the pawl. The tension of the spring serves to rotate the gear 38^a and its connected parts. This arrangement affords a longer continued driving than the previous one.

According to another form of my invention, the spring-motor action is secured by the means shown in Fig. 12 wherein each of the carrying wheels 34^a is loosely sleeved upon the shaft 33^a and attached thereto by the spiral spring 85. In this case one end of the spring is merely inserted in a hole in the wheel and the other end wrapped around a pin 86 which is stuck in the shaft, loss of the wheel being prevented by a cotter-pin 87. In this case a friction clutch is still necessary, which can be simply made by cam shaped enlargements 46^a formed at one end of a cylindrical sleeve 43^a upon whose exterior is journaled the hub 48^a of the worm gear 38^a whose rim is formed to provide the opposing portion of the clutch as shown at 90, the whole being attached together and to the shaft by the cotter pin 91.

Although the bag preferably covers the

entire open end of the fan chamber, I have found it advisable to restrict the outlet therefrom to a passageway adjacent to one wall, which I do by securing inside the chamber a curved plate 92, and this is preferably made of yielding material, such as thin sheet metal secured only at one end as 93 so as to permit displacement in case a person's fingers become caught and thus avoid serious injury.

The forward wall of the brush chamber immediately adjacent the lip 8 is preferably inclined forwardly in an overhanging manner so that the cleaner will tend to ride over such litter as matches, buttons, etc. rather than to push them along the floor. The interior surface of this wall preferably follows the brush surface clear to the opening so that any articles caught by the brush will be swept completely around the same and into the pan.

It will be understood that while all these details are valuable some are more important than others and may be used independently wherefore I do not limit myself to any of the details herein disclosed except as the same are recited in the annexed claims. The general relation of the fan and motor, the mode of supporting and driving the brush, and mode of securing the bag, the detail construction of the casing and clutch are covered in my related applications: #257,108, filed Oct. 7, 1918, #368,249, filed Mar. 24, 1920; #439,386, filed Jan. 24, 1921.

Having thus described my invention what I claim is:—

1. The combination with a dust pan, of a bag continuously and tightly attached to the rear end thereof, pneumatic devices arranged to draw air over said dust pan and discharge it into said bag, and a handle attached to said dust pan, said dust pan being arranged to tilt rearwardly upon being raised by said handle so as automatically to empty its contents into said bag.

2. The combination with a dust pan having at its forward edge a collecting lip and having at its rearward part a discharge opening located above the plane of said lip, of a handle pivoted to said dust pan upon a transverse axis, a bag connected to said handle and communicating with said opening, and means operative when said dust pan is raised by said handle to tilt the same and discharge its contents through said opening.

3. The combination with a dust pan having at one side a collecting lip and at the other side a discharge opening, of a rotatable brush located in operative relation to said lip, a handle pivoted to said dust pan upon an axis parallel to said lip, a bag connected to said handle and communicating with said opening, means for rotating said

brush to throw refuse upon said dust pan, and means operative upon raising said handle to tilt said dust pan rearwardly and discharge its contents through said opening.

4. The combination, in a suction sweeper, of carrying wheels, a rotary fan, and a spring motor wound up by the wheels and arranged to drive the fan.

5. In a device of the character described, the combination with a casing having a fan chamber and a suction fan, of a spring motor operatively connected to said fan, carrying wheels journaled to the casing, and operative connections between the wheels and motor whereby the latter will be wound up as the former are moved forwardly.

6. In a device of the character described, the combination with a casing having a fan chamber and a suction fan, of a transverse horizontal shaft journaled to said casing, carrying wheels on said shaft, a driving member sleeved on said shaft, operative connections between said member and fan, and spring connections between said shaft and member adapted to be wound up when said wheels are moved forwardly.

7. In a suction cleaner, a casing having a fan chamber and a collecting nozzle, said fan chamber having an inlet opening in its upper wall and said collecting nozzle overlapping said upper wall and enclosing said opening, said nozzle extending past the limits of said fan chamber and formed with a mouth whose plane lies below the lower wall thereof, the bottom wall of said nozzle adjacent to said mouth having a receiving ledge, a handle pivoted to said casing upon a transverse axis, a bag attached to said handle and communicating with said fan chamber at a point opposite to said nozzle, and means operative upon the raising of said casing by said handle to tilt said casing rearwardly so as to discharge into said fan chamber the litter lying on said ledge.

8. In a suction cleaner, a casing having a fan chamber and a collecting nozzle, said fan chamber having an inlet opening in one of its walls, and said collecting nozzle communicating with said opening, the bottom wall of said nozzle having a receiving ledge, a handle attached to said casing, a bag attached to said handle and communicating with said fan chamber at a point opposite to said nozzle, and means operative upon the raising of said casing by said handle to tilt said nozzle upwardly so as to discharge into said fan chamber the litter lying on said ledge.

9. In a floor cleaning device, a combined carpet sweeper and suction cleaner, the former comprising a brush and a dust pan and the latter comprising a suction fan and a dust bag, said fan chamber having a collect-

ing nozzle in which said brush and dust pan are located, a handle for operating the device, and means operative upon raising said handle for elevating said dust pan so as to empty its contents by gravity into said fan chamber.

10. In a device of the character described, a floor tool having a brush and a dust pan therein, a fan chamber having an intake communicating with said tool and also having an outlet, a dust bag attached to said outlet, and an operating handle adapted both to move said tool about the floor and by raising said floor tool to empty said dust pan into said bag.

11. In a suction cleaning device, a casing, a horizontal rotatable brush in said casing, a belt pulley carried thereby, a floor-roller supporting said casing and mounted in an opening so as to project partly inside the same while preventing leakage of air through said opening, a second pulley inside said casing, and a belt surrounding said pulleys, said belt and second pulley being so arranged relatively to said floor-roller that one of the same shall make operative contact therewith.

12. In a suction cleaning device, a casing, a horizontal rotatable brush in said casing, a belt pulley carried thereby, a floor-roller supporting said casing and projecting partly into the same, a second roller inside said casing and making contact with said first roller, said second roller having a groove, and a belt surrounding said pulley and second roller and received in said groove.

13. In a suction cleaner, a nozzle having a rotatable brush therein and also having an opening in its bottom wall, a vertically adjustable bracket in said opening, a floor roller carried by said bracket, a driven member carried by said bracket and operatively connected to said roller, and driving means operatively connecting said member and brush and adapted to operate in all positions of said bracket.

14. The combination with a floor-cleaning tool and a rotatable fan carried thereby, of carrying wheels therefor, and a spring motor carried by said tool and operatively connected to said fan and adapted to be wound up by the intermittent forward movements of said tool.

15. In a device of the character described, the combination with a casing having a fan chamber and a collecting nozzle, a suction fan in said chamber, a horizontal transverse shaft carried by the casing, driving and carrying wheels on said shaft, the former being operatively connected to said fan and the latter adapted to rest on the floor and one of the same being loose on the shaft, and a power spring connecting the shaft and loose wheel and adapted to be wound up by the forward movement of said carrying wheels.

16. In a device of the character described, the combination with a casing having a fan chamber and a suction fan, of a transverse horizontal shaft journaled to said casing, carrying wheels on said shaft, a driving member sleeved on said shaft, operative connections between said member and fan, a spring connecting said shaft and driving member arranged to be wound up as said wheels are moved forwardly, and means for preventing the release of said spring when said wheels are moved rearwardly.

17. The combination with a casing and a rotatable fan located in operative relation thereto, of carrying wheels, and means operatively connecting said wheels and fan, whereby the latter is rotated as said casing is advanced, said means including an energy-storing spring whereby said fan will be operated for a time after the advancing movement of said dustpan has ceased.

18. In a suction cleaner, a casing having a fan chamber and a collecting nozzle, said fan chamber being of pocket-shape and having openings in its side walls, a suction fan of greater diameter than either opening, one of said openings communicating with said nozzle, a fan shaft projecting through the other opening and detachably connected to said fan, a curved shield removably secured inside the open end of said chamber so as to define an outlet passage adjacent one of the side walls, and a collecting bag secured to the open end of said fan chamber.

19. In a suction cleaner, a fan chamber having a U-shaped side wall and flat sides connected to the margins of said wall, said flat sides having apertures, the one for a fan shaft and the other for the inlet of air, a collecting nozzle overlapping the last aperture, a yielding plate removably secured inside the open end of said fan chamber so as to define an outlet near one wall thereof, and a collecting bag secured to the open end of said fan chamber.

20. In a suction sweeper, a collecting nozzle and a fan chamber the former made from two pieces of sheet metal joined at their edges, one of which forms the bottom and is provided with an upturned lip, while the other forms a top therefor, one of said pieces having an outlet aperture surrounded by a neck and said fan chamber having an opening receiving said neck and interlocked therewith.

21. In a suction sweeper, a fan chamber supported in inclined position and having an inlet opening in its upper face, and a collecting nozzle overlying said fan chamber, said nozzle being made from sheet metal, one piece of which constitutes the bottom and is formed at one part with a receiving edge which extends near the supporting surface and at another part with a neck extending

into and interlocked with said inlet opening, the other piece of which constitutes the top and is secured to the lateral margins of the first piece.

5 22. In a suction sweeper, a fan chamber having a U-shaped side wall and flat sides connecting the margins of said wall, said sides having apertures for inlet purposes and fan shaft respectively, in combination with
10 a sheet metal collecting nozzle, having a part overlying the face of the inlet side and having a neck extending into said inlet opening and bent into engagement with the walls thereof.

15 23. The combination with a dust pan of a brush arranged to throw litter upon the dust pan, a fan adapted to draw air over the dust-pan, a handle so affixed to the dust pan that when raised the latter will be inclined so as
20 to facilitate the discharge of its contents into the fan, and a bag into which the fan discharges.

24. In a device of the character described, in combination, a fan chamber having an
25 outlet neck located in the plane of the fan chamber, said neck being oblong in cross-section and symmetrically disposed relatively to the fan chamber, means for securing a dust bag to said neck, and a shield located
30 inside said neck and defining an outlet passage which is eccentric of said fan chamber.

25. In a device of the character described, in combination, a rigid casing having a fan chamber, a collecting nozzle, and an outlet
35 neck, carrying wheels for said casing arranged to support the casing with the nozzle presented toward the floor on one side and the outlet neck projecting rearwardly on the opposite side, said outlet neck being elongated
40 laterally and arranged symmetrically upon opposite sides of the longitudinal axis of the

cleaner, means for securing a dust bag to said neck, and a shield located inside said neck so as to confine the outlet passageway to one side thereof. 45

26. In a suction sweeper, in combination, a casing, a centrifugal pumping device therein, floor engaging wheels carried by said casing, and operative connections between said wheels and pumping device, said connections including a spring adapted and arranged to permit a forward movement of said wheels during the time that said pumping device is held back by its inertia, where-
50 by a progressively increasing tension is imposed on said spring until such inertia is overcome. 55

27. In a suction sweeper, in combination, a casing, a rotary fan therein, a worm screw carried by the fanshaft, a worm wheel engaging said screw in driving relation, floor
60 engaging wheels carried by said casing, and operating connections between said carrying wheels and worm wheel, said connections including a spring adapted to be wound up
65 whenever the carrying wheels are rotated forwardly at a rate disproportionately larger than the rate of rotation of said fan.

28. In a suction sweeper, in combination, a casing, a pumping device therein, a floor
70 engaging wheel, operative connections between said wheel and pumping device including a spring which is adapted and arranged to be wound up whenever the carrying wheel is rotated forwardly at a rate disproportion-
75 ately larger than the rate of movement of said pumping device, and means additional to said spring for limiting the relative movement between said wheel and device.

In testimony whereof, I hereunto affix my
signature. 80

JAMES B. KIRBY.