May 5, 1936. N. H. WATTS 2,039,860

VACUUM CLEANER

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Fig. 6.

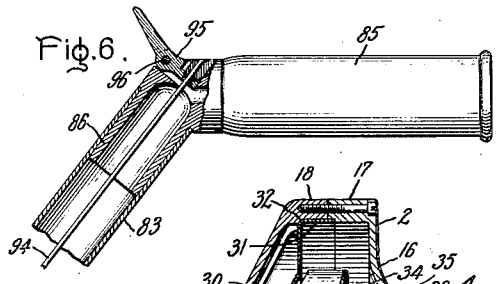


Fig. 1.

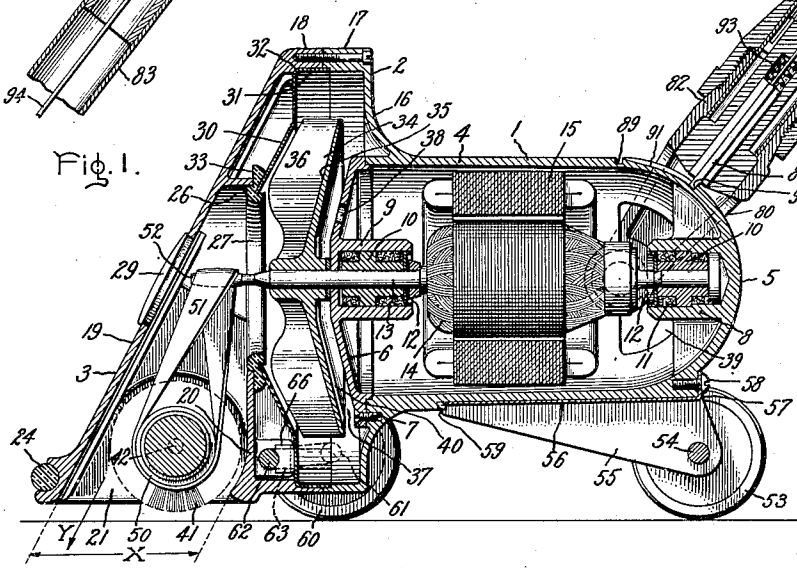


Fig. 4.

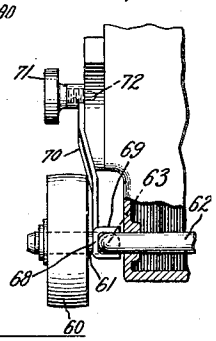


Fig. 2.

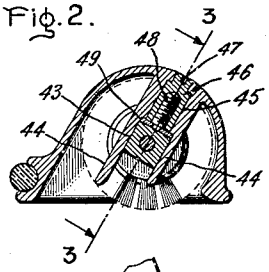


Fig. 3.

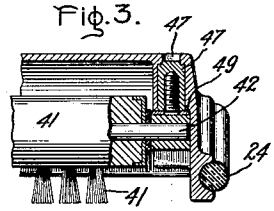


Fig. 7.

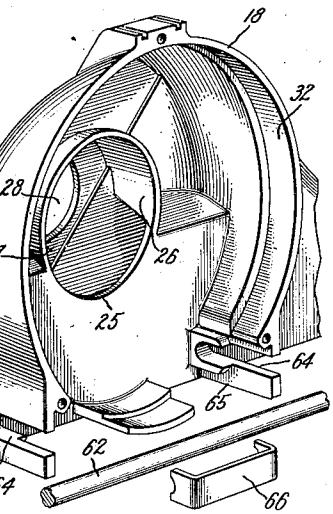
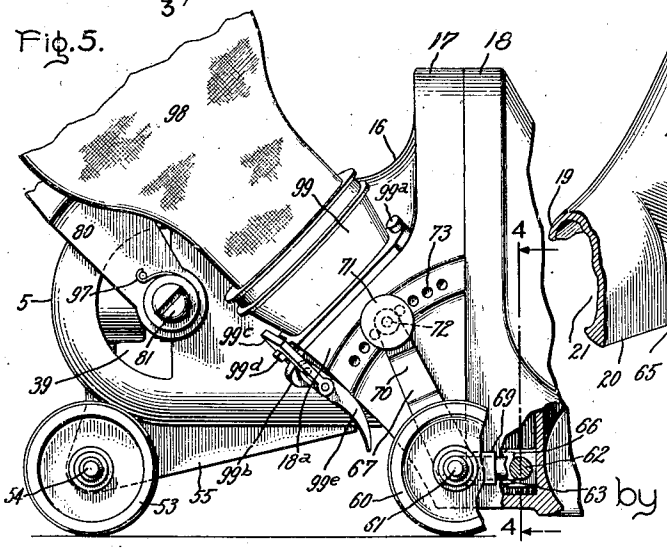


Fig. 5.



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Fig. 8.

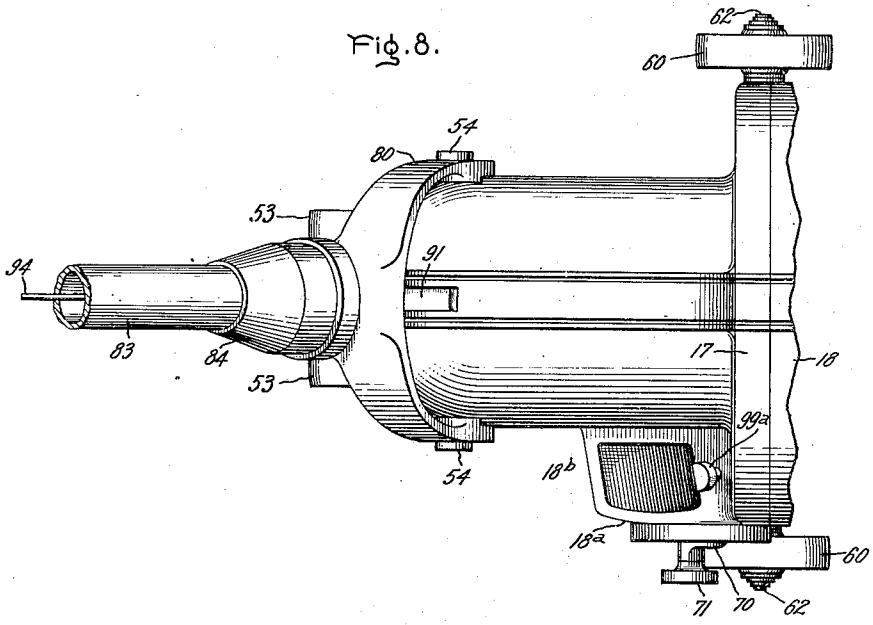


Fig. 9.

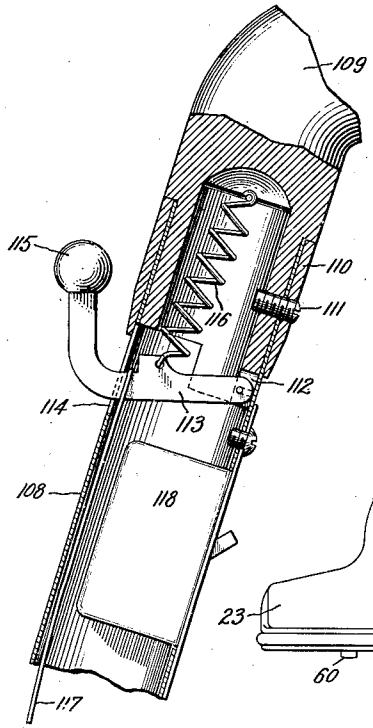


Fig. 10.

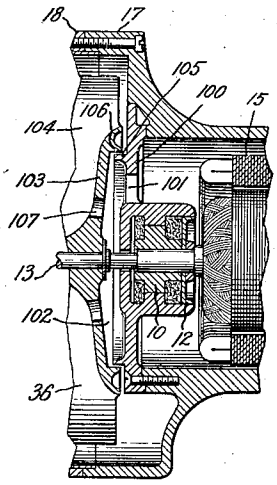
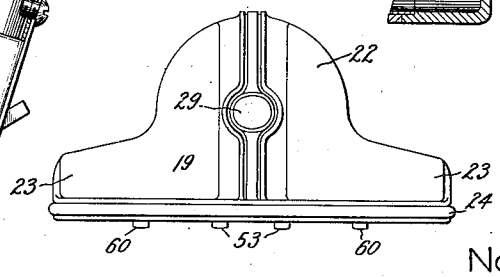


Fig. 11.



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UNITED STATES PATENT OFFICE

2,039,860

VACUUM CLEANER

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Application October 17, 1933, Serial No. 693,967

3 Claims. (Cl. 15—8)

The present invention relates to vacuum cleaners and has for its object to provide an improved vacuum cleaner which is simple in structure and capable of being manufactured at low cost.

For a consideration of what I believe to be novel and my invention attention is directed to the following specification and the claims appended thereto.

In the drawings, Fig. 1 is a longitudinal sectional view of a vacuum cleaner embodying my invention, the outer end of the handle being broken away; Fig. 2 is a sectional view through the end of the suction nozzle showing the arrangement for mounting the brush bearings; Fig. 3 is a detail sectional view taken on line 3—3 of Fig. 2; Fig. 4 is a detail view, partly in section, of the adjusting means for the front wheels, the section being along the line 4—4 of Fig. 5 looking in the direction of the arrows; Fig. 5 is a side view of a part of the cleaner, a portion of the outer nozzle wall being broken away; Fig. 6 is a detail view, partly in section, of the upper end of the handle showing the grip and the mechanism for actuating the handle locking means; Fig. 7 is a perspective view of the central portion of the nozzle, looking toward its inside; Fig. 8 is a top plan view of a part of the vacuum cleaner; Fig. 9 is a detail sectional view of a modified form of actuating mechanism for the handle lock; Fig. 10 is a detail sectional view showing a modified form of fan casing and ventilating means for the motor; and Fig. 11 is a front view of the vacuum cleaner casing.

Referring to the drawings, 1 indicates the motor casing, 2 indicates the fan casing, and 3 indicates the suction nozzle.

One feature of the invention has to do particularly with the construction of the motor casing, the fan casing, and the nozzle whereby the same comprise primarily two major parts, each of which is capable of being manufactured by die casting. To this end, a part of the fan casing is formed integral with the motor casing and a part is made integral with the nozzle. As will be pointed out more fully hereinafter, by this arrangement I am enabled to manufacture the casing structure of the cleaner at low cost.

The motor casing comprises a cylindrical side wall 4 having an integral rear end wall 5. The forward end of side wall 4 is open and is closed by a front wall 6 fixed in position by screws 7. Formed integral with rear end wall 5 and front wall 6 are inwardly projecting sleeves 8 and 9 in which are located bearings 10 of suitable bearing material, the bearings being surrounded in part by felt washers 11 which carry lubrication for the bearings. Preferably bearings 10 are formed from a suitable self lubricating material. Felt washers 11 hold an additional supply of lubricant which may be absorbed by the bearing material. This forms a satisfactory type of bearing and at the same time one which is simple in structure and easily assembled in place. The open ends of bearing sleeves 8 and 9 are closed by washers 12 which serve to prevent the entrance of foreign material to the bearings. Mounted in bearings 10 is a motor shaft 13 which carries a motor armature 14. Attached to wall 4 is the motor field 15.

Formed integral with the motor casing is a radially extending wall 16 which forms a part of the rear side wall of the fan casing, and formed integral with wall 16 is an axially extending wall 17 which forms a part of the surrounding wall of the fan chamber. The remainder of the surrounding wall of the fan chamber is formed by a wall 18 integral with the walls of the suction nozzle. At the rear of wall 16 is a wall 18^a (Figs. 5 and 8) which defines the discharge opening 18^b for the fan casing. Opening 18^b slopes downwardly and rearwardly and is adapted to have the vacuum cleaner bag connected to it.

The suction nozzle comprises front and rear walls 19 and 20 formed integral with each other and defining a suction inlet opening 21. The nozzle is circular at its central portion, as is indicated at 22, and slopes downwardly and outwardly to form the end portions 23 (see Fig. 11) of the nozzle. Surrounding the suction inlet opening 21 is a bumper 24 of suitable non-metallic relatively soft material, such as rubber.

Inside the central portion of the nozzle are walls 25 and 26 which define an opening 27 which serves to connect the suction nozzle to the fan chamber and through which motor shaft 13 projects into the suction nozzle. In front wall 19, in line with the end of shaft 13, is an opening 28 to give access to the end of the shaft, the opening being closed normally by a cap or plug 29 held by frictional contact or by other suitable means.

The forward or front wall of the fan chamber is defined by a separate annular plate 30 which may be made by stamping it from relatively thin sheet metal. It has a central opening in alignment with opening 27 and a rearwardly extending peripheral flange 31. Flange 31 fits in an annular groove 32 in walls 17 and 18 and seals

the joint between the walls 17 and 18. This serves to prevent leakage of dust or dust laden air through the joint. At its central portion plate 30 is supported by a ring 33 of suitable elastic material, such as rubber, for example, mounted in opening 27. This arrangement provides a tight seal between plate 30 and the surrounding wall of opening 27 and at the same time the ring serves to absorb vibration. Also, the arrangement has the advantage that while providing a tight seal, still it is easily assembled.

It will be seen that the motor casing 1 is entirely open at its inner or forward end and that the bearing housing 8 is open at the front. By this arrangement, the portion of the structure comprising motor casing 1, bearing housing 8, and walls 16 and 17, which form a part of the fan casing, may be made by die casting in a simple manner as the parts of the die can be easily separated. Likewise the nozzle and integral wall 18 may be made by die casting. To enable this to be accomplished, the walls 19 and 20 of the nozzle are so shaped and related to each other that the distance between the walls is greatest at the nozzle opening, that is at X, and the distance between the walls above the nozzle opening is the same as or less than distance X. This enables a die casting pattern to be removed from the nozzle in the direction indicated by the arrow *y*.

By my construction, the entire vacuum cleaner casing comprises two major parts which may be made by die casting, the plate 30, and the wall 6. Thus the entire casing structure can be manufactured at low cost.

Mounted on shaft 13 in the fan casing is a fan or impeller 34, the eye of which is in line with opening 27. The impeller may be of any suitable type. In the present instance, it is shown as comprising a disk 35 carried by a hub and provided on its front face with suitably curved vanes 36. Disk 35 is located in spaced relation to front wall 6, thus providing a space 37 between wall 6 and disk 35. Space 37 is connected with the motor casing through openings 38 located adjacent to the center of wall 6. By this arrangement I utilize fan 34 as a ventilating fan for the motor. For this purpose, the outer end of the motor casing is provided with ventilating openings 39 through which air enters the motor casing and after flowing over the motor windings to cool them, it passes through openings 38 and is discharged outwardly by the fan. In other words, when the fan is operating, it serves to effect a flow of air through passages 39 over the motor windings and through openings 38. The rear side of disk 35 acts as a centrifugal fan or blower to effect the flow of air. It will operate in a satisfactory manner without vanes or projections on its surface, the friction between the air and the surface of the disk being sufficient to create a flow of air. However if found desirable, I may provide shallow ridges or grooves as indicated at 40 to increase the pumping action. By this arrangement, I avoid the necessity of supplying a separate fan for ventilating the motor casing, and at the same time, I discharge the air used for ventilating the motor into the vacuum cleaner bag so that any dust which it may contain will be caught in the bag.

Located in the nozzle of the vacuum cleaner is a brush 41 provided with stub shafts 42 at its ends mounted directly in suitable bearing blocks 43. Bearing blocks 43 may be made with advantage of a self lubricating bearing metal, such metals being known. They comprise usually a suitable metal such as bronze, for example, which has been treated with a suitable lubricant such as graphite or oil. I have found bearings of this type to be entirely satisfactory for use as a bearing mounting for a vacuum cleaner brush. Bearing blocks 43 are adjustably mounted so that brush 41 may be adjusted relatively to the mouth of the suction nozzle. In the present instance, the bearing blocks are shown as being mounted between ways 44 formed by walls cast integral with the ends of the nozzle. At the inner ends of the ways are countersunk openings 45 in which are located elongated nuts 46 having slots 47 in their outer ends in which a tool may be inserted for turning the nuts. Located in each nut is a screw 48 having an enlarged head in the form of a plate 49 which rests against bearing block 43. In the present instance, plate 49 is shown as being provided with a rectangular slot in which is fastened a projecting tongue on the end of the screw 48. The screws 48 are held from turning by the plates 49 so that when nuts 46 are turned, the screws are moved axially relatively to the nuts. By this means, the bearing blocks may be adjusted along the ways 44 by turning the nuts 46.

The brush is provided with a pulley 50 on which a belt 51 runs, the belt engaging a pulley 52 on the end of the motor shaft. The brush is thus driven from the motor shaft. The belt 51 serves as the sole means for holding the bearing blocks in their ways, it serving to hold the blocks against the plates 49. When the brush is adjusted, the belt 51, which is made usually of a rubber compound, stretches sufficiently to permit the adjustment of the brush. Also due to its elasticity, it holds the brush bearing blocks 43 tightly against the plates 49. This arrangement provides a brush support which is simple in structure and easily adjusted.

The rear end of the vacuum cleaner is supported by two wheels 53 spaced a suitable distance apart. They are carried by a shaft 54 supported in ears 55 carried by a plate 56 which extends along the base of the motor casing 1, and is provided with a flanged end 57 fixed in place by screws 58. Ears 55 and plate 56 may be formed with advantage of a single piece of metal the ears being bent downwardly from the plate and the flange 57 being bent upwardly therefrom. Plate 56 follows closely the contour of the bottom of the motor casing, which may with advantage be provided with a recess for the reception of the plate. To hold the forward end of plate 56 the motor casing is preferably provided with an undercut groove such as is indicated at 59 in which the forward edge of the plate is located, it being held therein by the screws 58. This forms a simple supporting construction which can be manufactured at low cost and which can be quickly assembled.

At the forward end of the cleaner to the rear of the suction opening are two front supporting wheels 60, one on each side of the fan casing. They are carried on stub shafts 61 which project outwardly from the end arms of a U-shaped shaft comprising a cross rod 62 and end arms 63. The cross rod 62 is mounted in slots 64 in walls 65 at the rear of the suction nozzle and are held therein by projections 66 fastened to the rear wall of plate 30. With this arrangement, assembling the parts of the casing serves to fasten the cross rod in its bearing slots. The wheels 60 are adjusted vertically by turning cross rod 62 in the bearing slots. For this purpose, there is provided a crank 67 pivoted at its elbow on stub shaft 61 adjacent one of the wheels 60. One arm 68 of the crank is provided with angular flanges 69 which

engage opposite sides of arm 63 and the other arm 70 is provided with a button 71 which carries a projecting pin 72 adapted to engage openings 73 arranged in the arc of a circle on the side of the motor casing. Arm 70 is sufficiently flexible so that by pulling outwardly on button 71, the pin may be removed from the opening 73 in which it is located. When removed from an opening, the crank may be turned, thus turning cross rod 62 to raise or lower the wheels 60. When the wheels are adjusted to the desired position, the pin 72 is permitted to drop into the adjacent hole 73. This forms a simple adjusting means for the wheels and one which is readily operated.

The handle of the vacuum cleaner is pivoted to the motor casing at the rear thereof and on opposite sides of it. The handle is provided at its inner end with a yoke 80, the arms of which straddle the motor casing and are pivotally connected to the motor casing by pivot screws 81. At the central portion of the yoke is an outwardly projecting threaded hub 82 in which is located the lower end of a tube 83 which forms the major portion of the handle. The lower end of tube 83 is held in hub 82 by means of a nut 84 which screws over the hub. Preferably the hub is tapered slightly and is split longitudinally so that when nut 84 is screwed down, the hub is clamped tightly into engagement with the shaft. Connected to the outer end of tube 83 is a handle 85 which may be attached to it in any suitable manner. Handle 85 preferably extends at an angle to tube 83 and in the present instance, it is shown as being provided with a portion 86 which fits tightly inside the tube and may be riveted or screwed to it, if found desirable.

It is desirable to provide a latching means for the handle to hold the handle in its uppermost position relatively to the vacuum cleaner casing; also a means whereby the handle may be used to tilt the vacuum cleaner on its rear wheels. For this purpose, I provide the handle with a sliding latch 88, the end of which is adapted to engage in a notch 89 in the motor casing to fasten the handle in an upright position and to engage a stop 90 to enable the nozzle of the vacuum cleaner to be tilted upwardly by pressing down on the handle. Stop or shoulder 90 and notch 89 are connected together by a groove 91, the bottom wall of which slopes upwardly from stop 90 to the notch. By this means, the handle can be moved upwardly at any time to bring the latch into notch 89. Latch 88 is slidably mounted in a block 92 held in the lower end of tube 83. Block 92 is provided with an axially extending circular opening having grooves on opposite sides in which the edges of latch 88, which is in the form of a flat strip, slide. In the bottom of the circular opening is a spring 93 which bears against the end of the latch and serves to press it downward. Attached to the latch 88 is a wire 94 which extends up through tube 83 and at its upper end is connected to the inner end of a pivoted finger 95. Finger 95 is pivotally mounted on handle 85 by a pin 96, the outer end of the finger projecting outwardly so as to be within reach of a hand gripping handle 85. By pushing on finger 95, it will be seen that latch 88 can be lifted against the action of spring 93 to remove it from notch 89 or groove 91.

The normal angle for the handle when the cleaner is being used in such that latch 88 lies in groove 91 and moves forward and backward in the groove as the cleaner is moved back and forth. If it is desired to tilt the cleaner on its rear wheels 53 to lift the nozzle off the floor, this can be done by bringing latch 88 into engagement with stop 90 and then pressing downward on the handle. If it is desired to lower the handle below stop 90, it is necessary merely to push the finger 95 to release the latch 88 from the stop, when the handle can be moved downwardly, if desirable to the horizontal position. This enables the cleaner to be pushed under low articles such as beds or dressers. When the cleaner is to be lifted bodily, the handle is moved forward until latch 88 drops into notch 89. The handle is then held rigidly with respect to the cleaner so that the device as a whole can be lifted and carried.

Preferably in connection with the handle, I provide a coiled spring 97, (Fig. 5) which at one end engages a pin fastened to the handle and at the other end engages a fixed part of the motor casing. Spring 97 acts in a direction to move the handle upwardly toward notch 89. By the use of this spring, when the cleaner is being operated, the operator must always push downwardly on the handle by an amount sufficient to hold it against the action of spring 97. This serves to hold the rear end of the cleaner down so as to keep the wheels 53 firmly on the floor. Otherwise, there might be a tendency for the cleaner to turn on its wheels 60 as a pivot, lifting the rear end of the cleaner off the floor.

The bag for the vacuum cleaner is shown in part at 98. It may be of any suitable construction and connected at its outer end to the upper end of the handle in any suitable manner (not shown). The entrance mouth of the bag is connected to a metal sleeve 99 having a flanged opening adapted to fit over discharge opening 18^b. It is held in position by a pin 99^a carried by the fan casing and beneath the head of which ears formed by a notch in the flange surrounding the opening in sleeve 99 fit, and by a suitable clamp 99^b provided with a loop 99^c which engages over a pin 99^d on sleeve 99. Loop 99^c is pivoted to a finger 99^e. As will be clear from an inspection of Fig. 5, the clamp can be released by swinging finger 99^e outward and it can be tightened by swinging finger 99^e downward.

In Fig. 10 is shown a modified arrangement for ventilating the motor wherein instead of using the rear of the fan disk as a pumping means for effecting the flow of air over the motor windings, I utilize the vanes of the fan. In this arrangement, the plate 100 which closes the forward end of the motor casing is provided with openings 101 for the passage of air to the space 102 between the plate 100 and the disk 103 of the fan, the vanes of which are indicated at 104. Space 102 is sealed at its periphery by overlapping projections 105 and 106 on plate 100 and disk 103, and the space is connected to the eye of the impeller by openings 107 in disk 103. By this arrangement, when the fan is running, air is drawn in over the motor windings after the manner shown in Fig. 1 and passes through openings 101 and 107 to the space between the fan blades where it is discharged from the periphery of the blades. Otherwise the arrangement shown in Fig. 10 may be the same as that shown in Fig. 1.

In Fig. 9 is shown a modified handle arrangement. 108 indicates the upper end of the handle tube corresponding to tube 83 of Figs. 1 and 6. It is fastened to grip 109 by a sleeve 110 and set screw 111. Pivoted to a lip 112 on the lower end of the grip is a finger 113 which projects out through a slot 114 in tube 108 and has an upturned end provided with a ball 115. Connected

to arm 113 inside the tube is a spring 116, the upper end of which is fastened to a pin carried by grip 109. Spring 116 is a light spring being sufficient only to keep the wire 117, which corresponds to wire 91 in Figs. 1 and 6, taut. It is not sufficient to move the latch against the action of spring 93. Wire 117, which corresponds to wire 94 in Fig. 1, is looped over finger 113. By pressing the ball 115 toward the handle, it will be seen that the latch will be lifted to remove it from notch 89 or from shoulder 90. In Fig. 9, 118 indicates a switch for the vacuum cleaner. The switch is not shown in Fig. 6, but it will be understood that it will be arranged in a suitable manner in connection with the handle.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a vacuum cleaner, the combination of a motor casing comprising a cylindrical shell open at one end and closed at its other end, a wall integral with the shell at the open end thereof and forming a part of a fan chamber, a nozzle having front and rear walls defining a suction chamber having a discharge opening, a wall integral with the nozzle forming a part of a fan chamber, said fan chamber walls being united to each other at their peripheries, and detachable walls, one of which covers the open end of the said shell and another of which is carried by the nozzle for defining the remainder of the fan chamber, said wall carried by the nozzle comprising a part which seals the joint between the fan chamber walls integral with the shell and nozzle.

2. In a vacuum cleaner, a nozzle structure comprising walls which define a central enlarged portion having a discharge opening and an elongated inlet mouth, a rearwardly extending fan chamber wall integral with the nozzle structure, a resilient ring surrounding said discharge opening, and a plate having an opening in line with said discharge opening supported by said ring and rearwardly extending wall for forming part of the fan chamber.

3. In a vacuum cleaner, a casing having two parts, respectively providing a motor casing and a suction nozzle, one of said parts having a slot therein, a shaft for carrying supporting wheels adapted to fit in said slot, and means for securing said parts together, the other of said parts being arranged to engage said shaft and hold said shaft in said slot.

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