Feb. 26, 1924. 1,485,188

E. B. HOFF

SUCTION CLEANER

Filed Nov. 6, 1919

Fig. 1

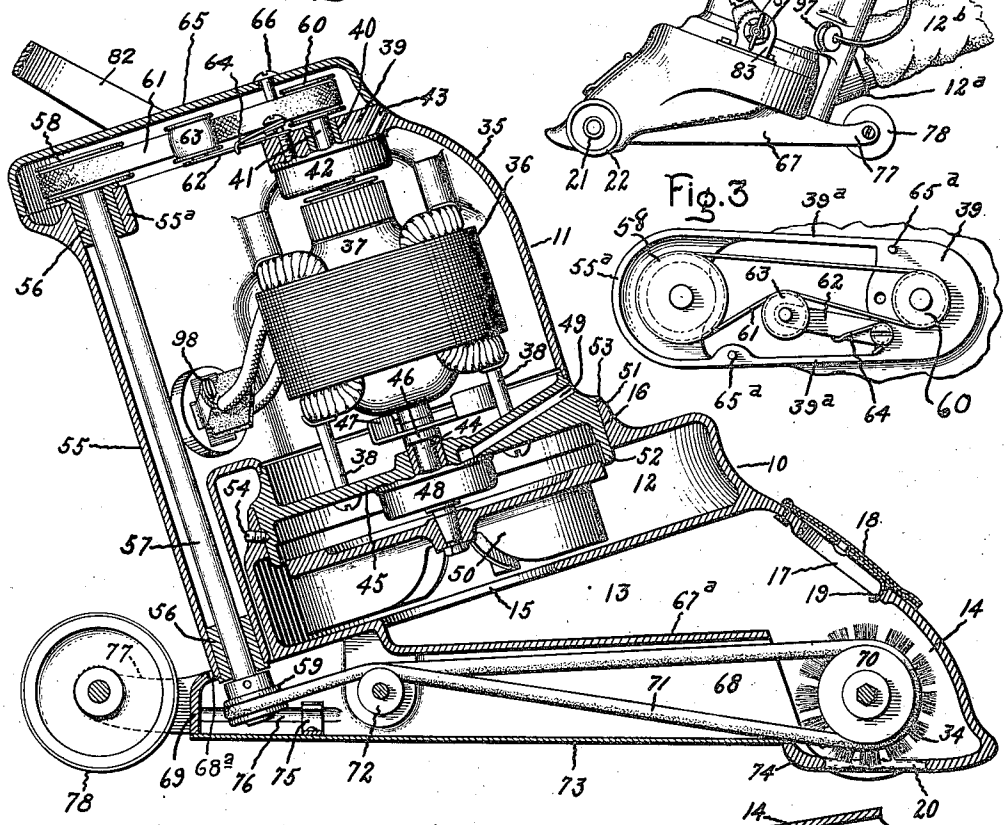


Fig. 2

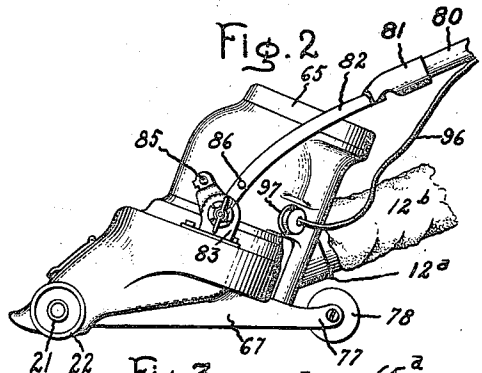


Fig. 3

Fig. 5

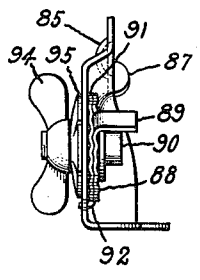


Fig. 4

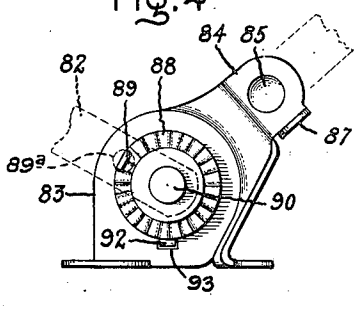
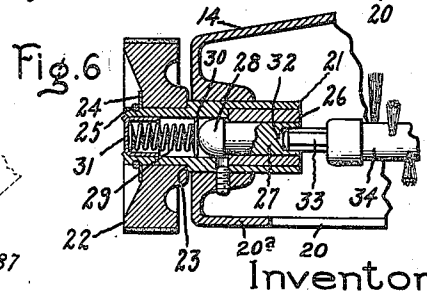


Fig. 6



Inventor:
Earl B. Hoff,
by Albert G. Davis
His Attorney.

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UNITED STATES PATENT OFFICE.

EARL B. HOFF, OF CLEVELAND, OHIO, ASSIGNOR TO ELECTRIC VACUUM CLEANER COMPANY, INC., A CORPORATION OF NEW YORK.

SUCTION CLEANER.

Application filed November 6, 1919. Serial No. 336,078.

To all whom it may concern:

Be it known that I, EARL B. HOFF, a citizen of the United States, residing at Cleveland, county of Cuyahoga, State of Ohio, have invented certain new and useful Improvements in Suction Cleaners, of which the following is a specification.

The present invention relates to electric suction or vacuum cleaners and particularly to cleaners of the portable type such as are primarily designed for household use and comprise essentially an electric motor which drives a suction fan, a casing having a chamber in which the fan is located, a suction nozzle communicating with the chamber, and a discharge conduit to which a dust bag is connected, the outer end of the dust bag being supported by the handle used in propelling the cleaner over the surface to be cleaned.

In such cleaners it is desirable to provide in the suction nozzle a suitable brush for loosening dirt, agitating the nap of a carpet or rug being cleaned, and picking up ravelings, bits of paper or other objects which have a tendency to stick to the surface being cleaned and are not readily taken up by suction alone. Such a brush operates most efficiently when rotated, and the primary object of the present invention is to provide an improved structure and arrangement in a suction cleaner of the type wherein a rotary brush is provided in the cleaner nozzle driven from the motor which drives the suction fan.

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

In the drawing, Fig. 1 is a central vertical sectional view of a suction cleaner embodying my invention; Fig. 2 is a side elevation on a smaller scale than Fig. 1; Fig. 3 is a top plan view of a belt drive; Figs. 4 and 5 are detail side and end views respectively of a stop mechanism for the cleaner handle, and Fig. 6 is a detail sectional view through one of the floor wheels showing the holding and bearing arrangement for the motor driven brush.

Referring to the drawing, 10 indicates the bottom part or floor piece of the cleaner and 11 the motor part which carries the fan and forms a unit in itself as will be pointed out hereinafter. The bottom part is preferably made as a single casting and comprises walls forming a fan chamber 12 and a passage 13 which communicates with the outlet opening of a suction nozzle 14. Suction nozzle 14 extends transversely of the cleaner as is well understood and at its central portion merges into the walls of passage 13. The walls of nozzle 14, passage 13 and fan chamber 12 merge smoothly by suitably curved surfaces into one another to give a pleasing appearance to the cleaner. In the bottom wall of fan chamber 12 is an inlet opening 15 with which passage 13 communicates and in the top wall of chamber 12 is an opening 16 through which the fan is introduced into chamber 12 and which is closed by the inner end of the motor casing. Connected with fan chamber 12 is a discharge conduit 12^a (Fig. 2) to which the inlet mouth of a dust bag 12^b is connected. In the front wall of passage 13 is an opening 17 normally closed by a hinged cover 18 which is held closed by a spring tongue 19. Opening 17 is adapted to have the end fixture of a hose fastened in it to adapt the cleaner for use with hose attachments for cleaning walls, etc., in the well known manner. The bottom wall of nozzle 14 lies in a horizontal plane and contains the usual suction inlet slot 20. Fixed in the end walls of nozzle 14 are tubular stuff shafts 21 (see Fig. 6), the outer ends of which form axles for side wheels 22 which are arranged to support the suction inlet slot of the nozzle a suitable distance above the surface to be cleaned. Wheels 22 are held against shoulders 23 on the axles by washers 24 and holding rings 25. The inner ends of stub shafts 21 are counterbored, and fixed in such counterbores are bearing bushings 26 in which are rotatable shaft holders 27. On their outer ends shaft holders 27 are provided with heads 28 against which press the inner ends of coiled springs 29, plates 30 being provided between the springs and the heads which serve as thrust bearing plates for the heads to turn on. Heads 28 are rounded as shown so there is only a limited bearing contact between them and plates 30 which reduces friction between the heads and plates

to a minimum. Also this arrangement makes it unnecessary for the parts to be accurately aligned for the bearing between plates 30 and heads 28 will be unaffected even though plates 30 do not stand at a right angle to the axis of shaft holders 27. The outer ends of springs 29 are carried in cup-shaped spring holders 31 suitably fastened in the outer ends of stub shafts 21 as by peening over the edges of the openings at spaced points as indicated in Fig. 6. Heads 28 present shoulders to the outer ends of bushings 26 to limit inward movement of the shaft holders. In the inner ends of shaft holders 27 are polyhedral recesses 32 which receive suitably shaped pieces 33 on the ends of the shaft of a brush 34 located in the nozzle inlet. It will thus be seen that the brush is carried in the shaft holders 27 and that it can be readily removed by first pushing it axially in one direction or the other until an end is freed from its holder 27; and it can be easily replaced by putting one end in its holder 27 and pushing it axially until the other end can be moved up in line with its holder. The springs 29 serve to center the brush axially. It will be noted that the bushings 26, holders 27 and springs 29 can be very easily and quickly assembled since they are slipped into place from the two ends of the stub shafts, and that when assembled the stub shaft, bushing, wheel, and holder form a unit which can be assembled prior to being mounted on the end wall of nozzle 14. So far as removing and inserting the brush into holders 27 is concerned, I need make only one of the end wheel structures of the arrangement shown in Fig. 6. However, I preferably make them both of such structure so they are interchangeable and can be replaced as a unit. As shown in Fig. 6, slot 20 does not extend entirely across nozzle 14 but terminates short of the ends thereof leaving a wall 20^a. In operation the carpet or rug is sucked up into contact with the nozzle sealing slot 20 and walls 20^a serve as sealing walls for the slot ends and eliminate the possibility of wheels 22 preventing the rug from sealing the slot.

The motor part 11 of the cleaner comprises the motor shell 35 in which is supported the field 36 and armature 37 of the motor. Field 36 is shown as being held in position by posts 38. The top of shell 35 terminates in a substantially round, flat plate 39 which has considerable thickness and which carries a bearing sleeve 40 for the upper end of armature shaft 41. Fastened to the under side of plate 39 is a lubricant cup 42 to which lubricant may be supplied through a hole 43. The lower end of armature shaft 41 is journaled in a bearing sleeve 44 carried by a plate 45 which closes the lower end of shell 35. On the lower end of shaft 41 is fixed a hub 46 which carries motor ventilating fan blades 47 and which rests against the upper end of sleeve 44 to support the weight of the armature. Fastened to the under side of plate 45 is a lubricant cup 48 to which lubricant may be supplied through a hole 49. End plate 45 is fastened to shell 35 by the posts 38 which position the motor field 36. The lower end of shaft 41 extends beyond plate 45 and lubricant cup 48 and on its end is mounted a fan 50 which is located in fan chamber 12 and forms the suction fan of the cleaner. Opening 16 in the top wall of fan chamber 12 is surrounded by a flange 51 and end plate 45 has a flange 52 which slips inside it and a shoulder 53 which rests on top of it. The two flanges are fastened together by a suitable number of screws 54. This gives a firm, strong and easily assembled connection between the motor part and floor piece of the cleaner but one which at the same time is easily released to permit the motor part being removed from the floor piece.

Formed integral with the rear side of shell 35 is a tube 55, the upper portion of which merges into shell 35 except at its top, where it maintains its tubular shape as indicated at 55^a. The upper end of tube 55 terminates flush with the outer surface of plate 39 and the same are connected together by integral side walls 39^a which curve smoothly into and form an integral part of motor shell 35. Or viewed from another aspect it may be considered that motor shell 35 is provided at its rear with walls forming a rather flat integral extension running lengthwise of the shell, the contour of which is best indicated in Fig. 2, such extension continuing beyond the lower side of the motor shell in the form of a tube. The lower portion of tube 55 projects below shell 35 to a point flush with the bottom of fan chamber 12. In the two ends of tube 55 are bearing bushings 56 which carry a shaft 57. On the upper end of shaft 57 is a belt wheel 58 and on the lower end is a belt wheel 59. The upper end of motor shaft 41 projects beyond the top surface of plate 45 and carries a belt wheel 60 which is connected to belt wheel 58 by a belt 61. A belt tightener is provided for belt 61 comprising an arm 62 pivoted at one end on plate 39 and carrying at its other end a roller 63 which is pressed against belt 61 by a spring 64. Belt wheels 58 and 60 and belt 61 are covered by a cap 65 which is held in position by projecting pins 65^a (Fig. 3) which enter holes in the bottom edges of the side walls of cap 65 and a bolt 66 which passes through an opening in cap 65 and threads into plate 39. Cap 65 fits evenly against the upper edges of walls 39^a and completely closes the upper end of shell 35.

Formed integral with the floor piece 10 on its bottom and running crosswise of it are two spaced walls 67 which form a channel 68, one end of which opens into nozzle 14 adjacent the central portion of brush 34. Walls 67 pass through chamber 13 as shown in Fig. 1 and are closed at the top by an integral wall 67ª. The other end of channel 68 is closed by an integral end wall 69 and such end houses belt wheel 59. At the central portion of brush 34, its shaft is provided with a belt wheel 70 and located in channel 68 is a belt 71 which connects belt wheels 59 and 70. A pair of idler wheels or rollers 72 are provided in channel 68 over which belt 71 passes, such idler wheels serving to space the two strands of the belt, bring the one end of the belt into the plane of belt wheel 59 and guide the belt in its movement. Preferably the two wheels 72 are placed a distance apart which is either greater or less than the diameter of belt wheel 59 at the bottom of its groove thereby maintaining a slight side pressure on belt 71 which prevents it from running off. The open side of channel 68 is closed by a cover plate 73, one end of which rests on the rear wall of the nozzle, as indicated at 74, the other end being provided with spring fingers 75 which engage grooves 76 in the faces of walls 67. By this arrangement cover plate 72 is positively held at its front end so it can never drop down. At the same time the cover plate can be quickly and easily removed and replaced. At the rear, walls 67 are extended to form a pair of spaced ears 77 between which a rear roller or wheel 78 is pivoted. Wheel 78 is well crowned or rounded on its head to permit of easy sidewise sliding of the rear end of the cleaner when in use and it is of quite large diameter so it will roll over obstacles freely and easily.

With the above described arrangement it will be clear that when the motor is in operation one end of motor shaft 41 drives suction fan 50 and the other end drives brush 34 through the medium of belt 61, shaft 57 and belt 71. It will be noted that belt wheel 58 is larger than belt wheel 60 and that belt wheel 59 is smaller than belt wheel 70 so that I obtain a double reduction in speed between the motor shaft and the brush. This is very important as the motor of a suction cleaner in order to pump the desired volume of air must run at a much higher speed than it is desirable to run the brush, since such high speed of the brush produces undue wear of the rug or carpet being cleaned and at the same time does no more efficient work. By means of my arrangement of double reduction drive between the motor shaft and the brush I am enabled to reduce the speed of the brush to a value very much lower than that of the motor shaft. For example, I find that I can reduce the speed of the brush to from 1/5 to 1/7 of that of the motor shaft and at the same time I am not required to unduly enlarge any part of the cleaner to accommodate large belt wheels.

By utilizing both ends of the motor shaft for driving purposes, one end driving the suction fan and the other end the brush, I obtain a better balance for the driving motor and also a structure wherein the belts can be made readily accessible. In this connection it is to be noted that belt 61 and belt wheels 58 and 60 are above the motor shell 35 and are rendered accessible by removing cap 64 and that belt 71 and belt wheel 59 are below the fan casing and are rendered accessible by removing cover plate 73. Belt wheel 70 is readily accessible through nozzle slot 20 and channel 68. At the same time the belt wheels and belts are normally wholly enclosed.

Furthermore the arrangement of belts and belt wheels and of shaft 57 renders the original work of assembling simple and easy. Since tube 55 which carries the bearings 56 for the two ends of shaft 57 is formed as an integral structure with the motor shell, bearings 56 when slipped into the ends of tube 55 will be correctly aligned to receive shaft 57 and such bearings cannot get out of alignment. In this connection it is to be noted that the two ends of tube 55 can be bored out at the same time, in the same fixture, and at a single setting to receive bearings 56 which means that bearings will always have good alignment. In assembling, therefore, it is only necessary to insert bearings 56 into the ends of tube 55, run shaft 57 through and fasten belt wheels 58 and 59 thereon. Belts 61 and 71 can then be easily put into place.

It is desirable that dust and other foreign material be prevented from accumulating in channel 68 and I accordingly provide at the outer end of the channel a suitable opening or openings through which a small amount of air can pass. With this arrangement when the suction fan 50 is operating it will draw air through such opening or openings into channel 68 thence through channel 68 to the passage 13. By this means there is a continuous flow of air through channel 68 which prevents any accumulation of foreign material taking place therein. In the present instance, the opening at the outer end of channel 68 is formed around the lower end of tube 55 as indicated at 68ª.

The cleaner is formed essentially of two parts, the floor piece 10 and the motor part 11. As regards tube 55 which carries shaft 57, the essential point is that it be formed integral with or carried entirely by one of these parts so the bearing 56 when inserted therein will be correctly aligned and maintained so, and while I preferably form the tube as a part of the motor shell it will be

understood that my invention is not necessarily limited to such arrangement as the tube could be readily formed as a part of the floor piece. Furthermore, while I prefer belt drive on account of its quiet running properties and ease of manufacture and assembly, other forms of drive, such, for example, as a gear drive, may be used if found desirable.

The handle of the cleaner is indicated in Fig. 2 at 80 and at its lower end fits into a socket 81 from which branches two spring arms or furcations 82. The ends of arms 82 are pivoted on suitable shafts 90 carried by ears 83, which ears are fastened to the fan casing on opposite sides of the motor. One of the ears 83 is provided with a projecting spring finger 84 having a socket 85 pressed in its end and the adjacent arm 82 is provided with a bead 86 for engaging in socket 85. Integral with finger 84 is a right angle flange 87 which projects into the path of movement of arm 82 to form a stop for it. The purpose of spring finger 84 and stop 87 is to provide a means whereby the handle of the cleaner may be fastened in an upright position and its movement beyond an upright position prevented. In order to enable the handle to be adjusted to various positions and maintain it there, I provide a yielding holding means comprising a radially corrugated disk 88 having a right angle lug 89 which projects into an opening 89[a] in arm 82 and is on the same shaft 90 that arm 82 is pivoted on, being located between arm 82 and ear 83. Adjacent disk 88 is a second radially corrugated disk 91, held stationary by an integral inturned lug 92 which engages an opening 93 in ear 83. Shaft 90 projects through ear 83 and its outer end is threaded to receive a wing nut 94. Between wing nut 94 and ear 83 is a dished spring washer 95. Wing nut 94 is tightened to bring corrugated disks 88 and 91 into engagement and they are held yieldingly in engagement by spring washer 95. If now handle 80 is moved up or down, disk 88 will turn with it, spring washer 95 yielding sufficiently to let the corrugations of disk 88 ride over the tops of the corrugations of disk 91. The handle can thus be adjusted step by step, the resistance offered to adjusting depending on the adjustment of wing nut 94 as is obvious. In the final upright position of the handle, which may be vertical or to one side of vertical as found desirable, arm 82 engages the side of spring finger 84, bead 86 snapping into socket 85 so as to hold the handle in such position. It cannot be moved beyond such position due to stop 87.

In Fig. 2, 96 indicates the cord having a plug 97 at its ends for engagement with the contact fingers to which the terminals of the motor are connected. The location of these terminal connections is indicated at 98 in Fig. 1.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative, and that the invention may be carried out by other means.

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

1. In a suction cleaner, the combination of a substantially horizontal fan chamber, a suction nozzle connected therewith, a rotatably mounted brush in said nozzle, a motor mounted on the fan chamber with one end of its shaft projecting into it, a fan on such end, a shaft carried by the motor shell, and separate power transmitting means connecting one end of such shaft to the end of the motor shaft remote from the fan and the other end to said brush.

2. In a suction cleaner, the combination of a fan chamber, a suction nozzle connected therewith, a rotatably mounted brush in said nozzle, a motor mounted on the fan chamber with one end of its shaft projecting into it, a fan on such end, a shaft carried by the motor shell, said shaft extending parallel to the motor shaft, means connecting one end of such shaft to the end of the motor shaft remote from the fan, and means connecting the other end of such shaft to said brush.

3. In a suction cleaner, the combination of a fan chamber, a suction nozzle connected therewith, a rotatably mounted brush in said nozzle, a motor mounted on the fan chamber with one end of its shaft projecting into it, a fan on such end, a shaft carried by the motor shell, said shaft extending parallel to the motor shaft and from a point beyond the motor casing to a point below said fan chamber, means connecting the end of such shaft which is beyond the motor casing to the motor shaft, and means connecting the other end of such shaft to said brush.

4. In a suction cleaner, a floor piece comprising a fan chamber having inlet and discharge openings and a nozzle connected to said inlet opening, a motor part comprising a motor having a shaft, a shell, and a fan connected to said shaft, said motor part being mounted on said floor piece with the fan in said fan chamber, a tube carried by the motor shell, said tube being parallel to the motor shaft a shaft mounted in such tube, a brush in the cleaner nozzle, and separate power transmitting means connecting said last named shaft to the motor shaft and to said brush.

5. A suction cleaner comprising essentially two parts, a floor part having a fan chamber and a nozzle and a motor part,

a brush in said nozzle, a tube formed integral with one of said parts, said tube extending parallel to the axis of the motor, bearings in the ends of said tube, a shaft journaled in said bearings, and power transmitting means connecting one end of said shaft to the motor and the other end to said brush.

6. In a suction cleaner, the combination of a fan casing, a fan therein, a motor having its shell connected to the fan casing and one end of its shaft connected to said fan, a shaft parallel to the axis of the motor which extends from a point beyond the motor shell to a point beyond the fan casing, a nozzle connected to the fan casing, a brush in said nozzle, power transmitting means connecting one end of said last named shaft to the motor shaft, and power transmitting means connecting the other end of such shaft to said brush.

7. In a suction cleaner, the combination of a fan casing, a fan therein, a motor having its shell connected to the fan casing and one end of its shaft connected to said fan, a tube at the rear of the cleaner which extends parallel to the axis of the motor, the ends of said tube terminating adjacent the top of the motor casing and the bottom of the fan casing, a shaft journaled in said tube with its ends projecting beyond the ends of the tube, pulley wheels on the ends of such shaft, a pulley wheel on the end of the motor shaft remote from said fan, a belt connecting it to one of the pulleys on said second named shaft, a nozzle connected to the fan casing, a brush therein, a pulley wheel on said brush, and a belt connecting it to the other of the pulleys on said last named shaft.

8. In a suction cleaner, the combination of a fan casing, a fan therein, a motor having its shell connected to the fan casing and one end of its shaft connected to said fan, a tube at the rear of the cleaner which extends parallel to the axis of the motor, the ends of said tube terminating adjacent the top of the motor casing and the bottom of the fan casing, a shaft journaled in said tube with its ends projecting beyond the ends of the tube, pulley wheels on the ends of such shaft, a pulley wheel on the end of the motor shaft remote from said fan, a belt connecting it to one of the pulleys on said second named shaft, a nozzle connected to the fan casing, a brush therein, walls defining a channel extending across the bottom of the fan casing and terminating in said nozzle, a belt wheel on the brush in front of said channel, and a belt in said channel connecting the belt wheel on the brush to the other belt wheel on said second named shaft.

9. In a suction cleaner, the combination of a substantially horizontal fan casing, a suction nozzle extending forwardly and laterally thereof, a brush in said nozzle, a motor mounted on the top of said fan casing, a tube extending along the rear of the fan and motor casings, a shaft journaled therein, the lower end of which terminates below the fan casing, walls forming a channel which extends across the bottom of the fan casing from the lower end of said shaft to the nozzle, power transmitting means located in said channel which connects the lower end of such shaft to said brush, and power transmitting means connecting the upper end of such shaft to the motor shaft.

10. In a suction cleaner, the combination of a substantially horizontal fan casing, a suction nozzle extending forwardly and laterally thereof, a brush in said nozzle, a motor mounted on the top of said fan casing, a tube extending along the rear of the fan and motor casings, a shaft journaled therein, the lower end of which terminates below the fan casing, walls forming a channel which extends across the bottom of the fan casing from the lower end of said shaft to the nozzle, said channel having an open side, power transmitting means located in said channel which connects the lower end of such shaft to said brush, power transmitting means connecting the other end of such shaft to the motor shaft, and a removable cover for the open side of said channel.

11. In a suction cleaner, the combination of a nozzle having end walls, hollow stub shafts fixed in said end walls and projecting beyond them, wheels mounted on such projecting ends of the stub shafts, shaft holders rotatably mounted in the inner ends of said hollow stub shafts, springs mounted in the outer ends thereof and acting to yieldingly press said shaft holders toward each other, and a brush in the nozzle, said brush having shaft ends carried by said shaft holders.

12. In a suction cleaner, the combination of a nozzle having end walls, hollow stub shafts fixed in said end walls and projecting beyond them, wheels mounted on such projecting ends of the stub shafts, shaft holders rotatably mounted in the inner ends of said hollow stub shafts, spring-pressed thrust bearing members which press on the outer ends of the shaft holders to yieldingly force them toward each other, a brush in said nozzle, said brush having shaft ends detachably connected to said shaft holders, and means for rotating said brush.

13. In a suction cleaner, the combination of a nozzle having an end wall, a tubular stub shaft fixed therein with one end projecting beyond the wall, a wheel rotatably mounted on such projecting end, a shaft holder in the inner end of said tubular stub shaft, a spring in the outer end thereof which bears against the shaft holder, means

for holding the spring therein, and means for limiting the axial movement of said shaft holder.

14. In a suction cleaner, the combination of a nozzle having an end wall, a tubular stub shaft fixed therein with one end projecting beyond the wall, a wheel rotatably mounted on such projecting end, a shaft holder in the inner end of said tubular stub shaft, said shaft holder having a rounded head, a thrust bearing plate, and a spring in the outer end of said tubular shaft which forces the thrust bearing plate against said rounded head.

15. In a suction cleaner, the combination of a fan chamber, a fan therein, a motor for driving the fan, a nozzle connected to the fan chamber, a brush in said nozzle, means forming a channel which extends across the bottom of the cleaner and communicates at one end with said nozzle, the other end being closed, power transmitting means in said channel for driving the brush, and a plate for closing the open bottom of the channel, said plate being positively supported at its forward end on a wall of the nozzle.

16. In a suction cleaner, the combination of a substantially horizontal fan chamber, a fan therein, a motor mounted on the upper side of said fan chamber and connected to said fan, the outer end of the shaft of the motor projecting beyond the motor shell, a nozzle connected to the fan chamber, a brush in said nozzle, means for driving the brush which means comprises a shaft which projects above the motor shell into line with the outer end of the motor shaft, a belt connecting the upper ends of such shafts, and a removable cap fastened to the motor shell for housing said belt and shaft ends.

In witness whereof, I have hereunto set my hand this 3rd day of November, 1919.

EARL B. HOFF.