July 10, 1956

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SUCTION CLEANING APPARATUS HAVING AUTOMATIC BRUSH ADJUSTMENT

2,753,585

Filed May 15, 1953

3 Sheets-Sheet 1

FIG. 1.

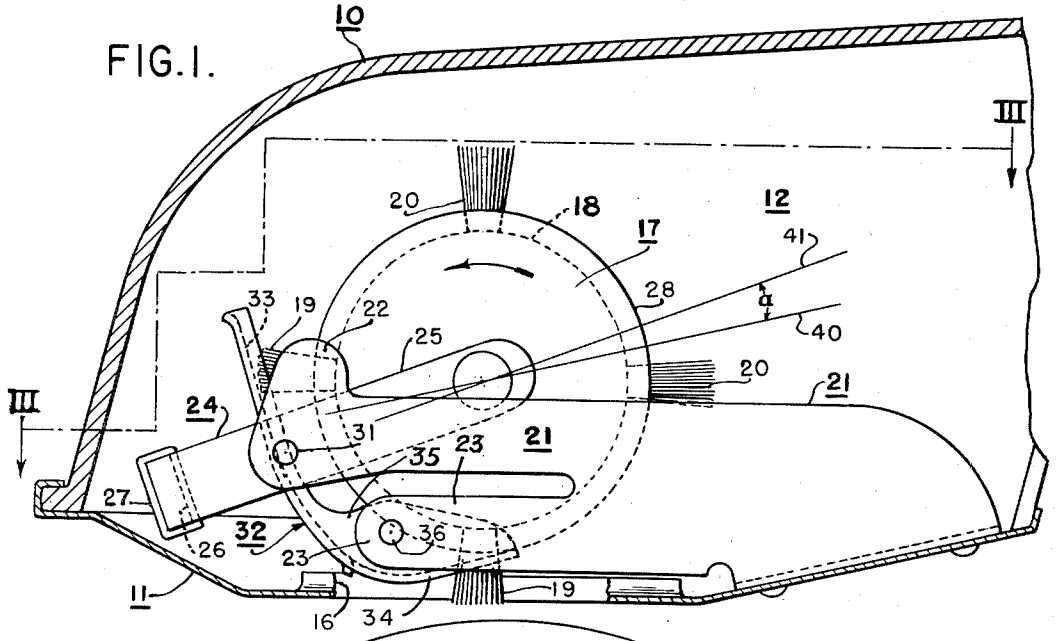
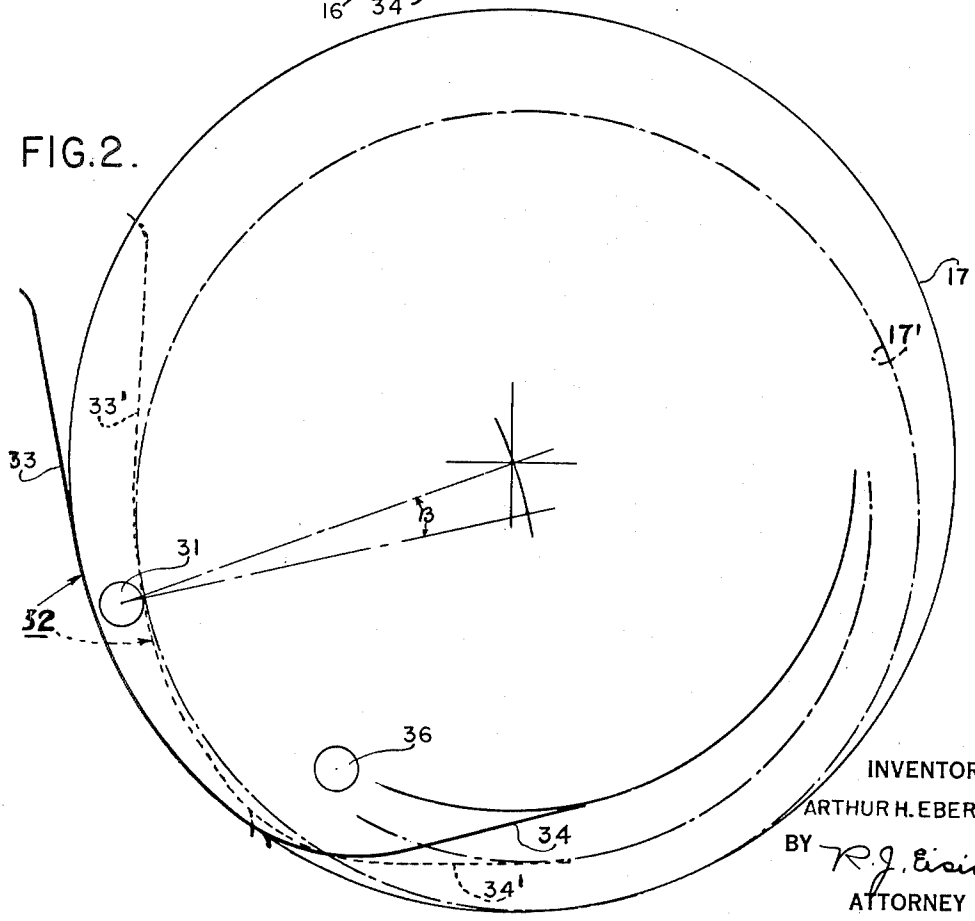


FIG. 2.



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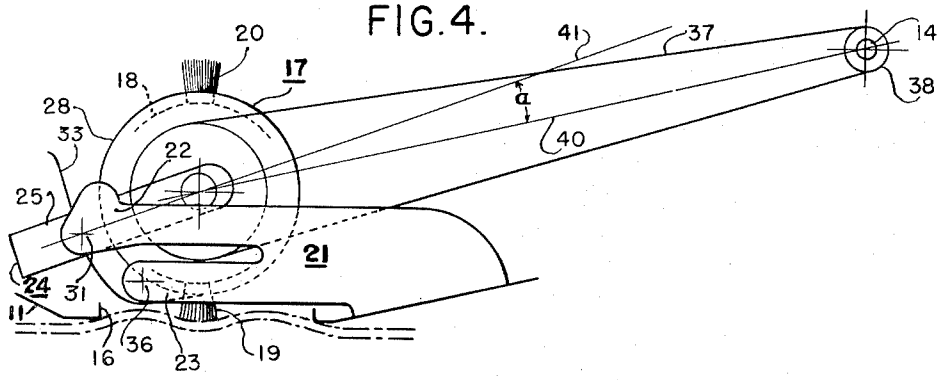
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3 Sheets-Sheet 2

FIG. 4.



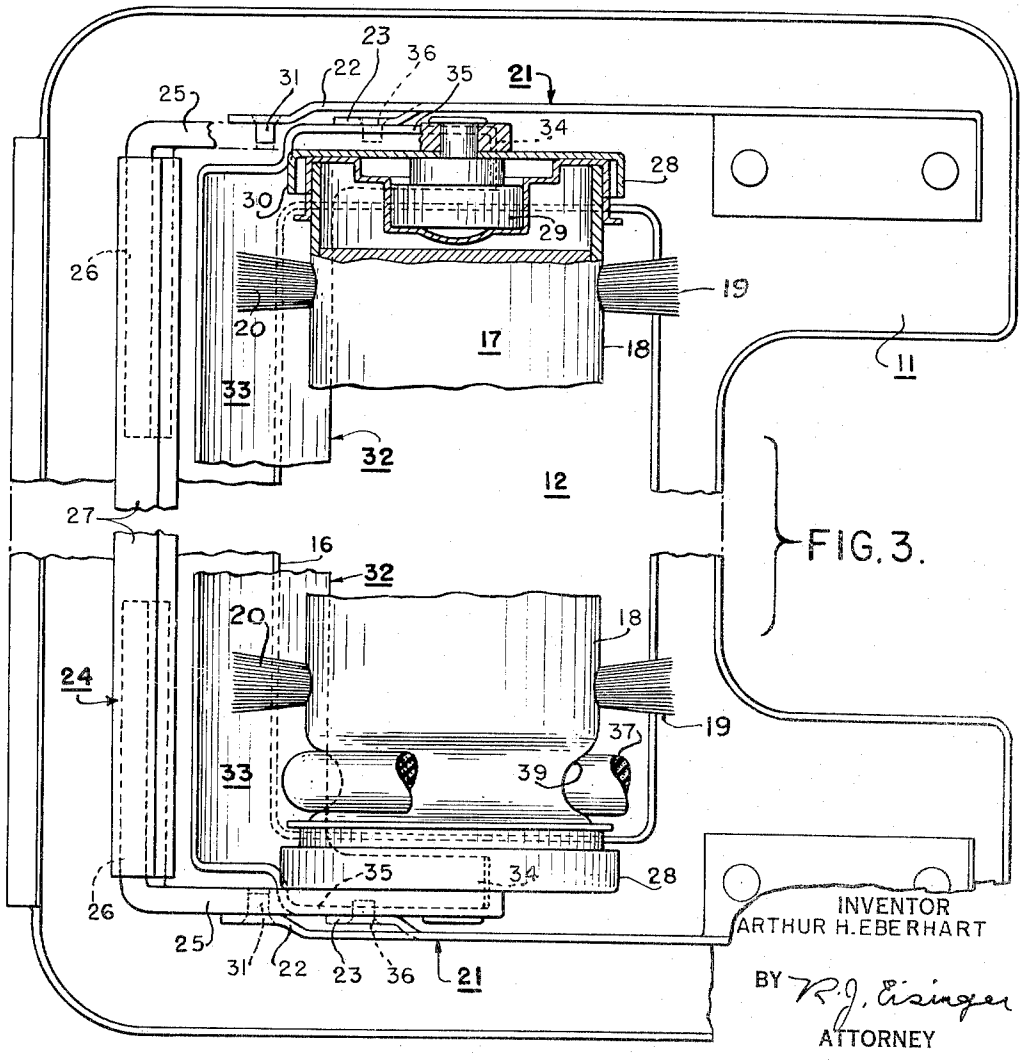


FIG. 3.

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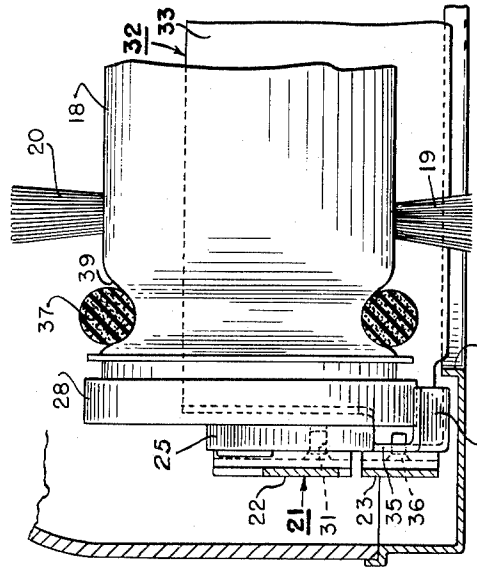


FIG. 5.

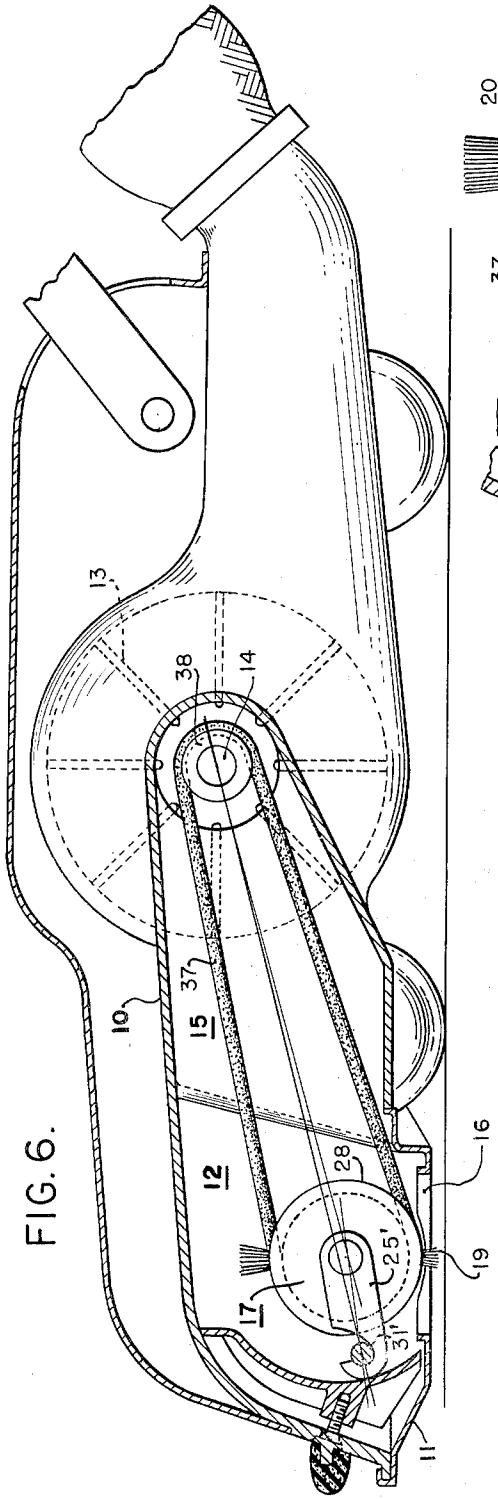


FIG. 6.

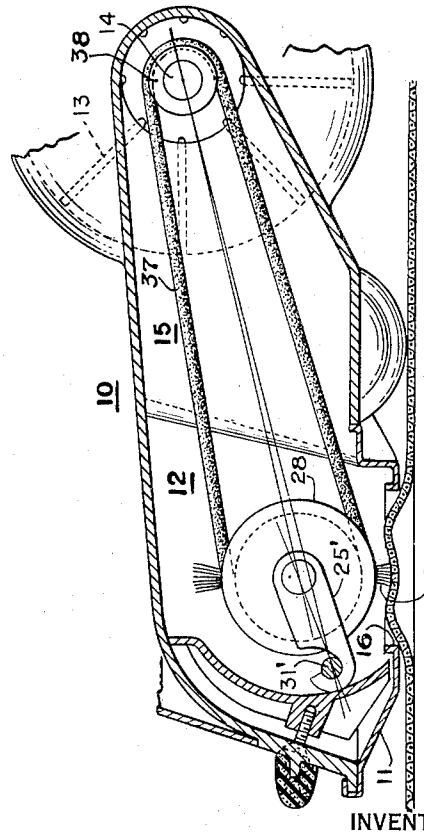


FIG. 7.

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SUCTION CLEANING APPARATUS HAVING AUTOMATIC BRUSH ADJUSTMENT

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Application May 15, 1953, Serial No. 355,391

2 Claims. (Cl. 15—319)

My invention relates to a suction cleaner, more particularly to a mechanism for adjusting, vertically, the position of the rotatable brush roll thereof.

It is an object of the invention to provide a mechanism for vertically adjusting the rotatable brush roll automatically.

A further object is to provide a mechanism for automatically raising the brush roll to an adjusted position, while at the same time permitting the brush roll to be further raised, during operation, by engagement with the rug being cleaned.

These and other objects are effected by my invention as will be apparent from the following description taken in connection with the accompanying drawing, forming a part of this application, in which:

Fig. 1 is a side view of the front end or nozzle portion of a suction cleaner in accordance with one embodiment of my invention, having a new rotatable brush roll in idle or starting position, portions of the housing and the carpet guard being shown in section or cut away;

Fig. 2 is a schematic diagram showing two positions of the rotatable brush roll and its associated lever;

Fig. 3 is a plan view, partly in section, taken on line III—III of Fig. 1;

Fig. 4 is a schematic diagram, on a smaller scale, showing a new rotatable brush roll in its operating position, and also showing the belt tension;

Fig. 5 is a fragmentary vertical sectional view, showing the member for supporting and adjusting the brush roll;

Fig. 6 is a longitudinal vertical section, showing a suction cleaner incorporating a second embodiment of my automatic brush roll adjusting mechanism; and

Fig. 7 is a partial view similar to Fig. 6 but showing the brush roll in raised, operating position.

Referring to Figs. 1 and 3 of the drawing, there is shown the front or nozzle end of a suction cleaner of the handle-maneuvered or floor type, the cleaner having a housing **10** and a detachable rug guard **11**, which enclose the nozzle or suction space **12**. Except for the brush roll adjusting mechanism, the cleaner is the same as that of the second embodiment shown in Fig. 6. Suction is created in the nozzle **12** by a fan **13** mounted on the shaft **14** of the drive motor, which motor is hidden by the fan in Fig. 6. The inlet of the fan **13** communicates with the nozzle through a suitable passage **15**. The nozzle is provided with an inlet opening or mouth **16** formed in the rug guard **11**. In accordance with conventional practice, the nozzle **12** is supported in elevated position above the rug or floor covering to be cleaned. so that the portion of the rug directly below the inlet **16** is drawn upwardly into the inlet opening as shown in Fig. 4.

Referring to Fig. 1, a rotatable brush roll **17** is disposed within the nozzle **12** directly above and in registry with the inlet opening **16**. The brush comprises a cylindrical body **18** having a row of tufts of short stiff bristles **19**, extending radially outwardly from the body **18**. The row of bristles extends helically around a substantial part, usually about one-half, of the circumference of the brush roll. The brush roll of the illustrated embodiments is also provided with a helical row of long soft bristles **20**, disposed diametricaly opposite the bristles **19**. The two tufts **19** shown in Fig. 1 are disposed in different planes, these particular tufts having been chosen for illustration to show their operative relation to parts of the cleaner.

During operation of the cleaner, the brush roll is rotated about its horizontal longitudinal axis, so that the bristles sweep the rug being cleaned and also agitate the rug to loosen embedded dirt, in order that the dirt may be more easily entrained in the air stream flowing through the inlet **16** and the nozzle chamber **12**.

The first embodiment of the mechanism for supporting and adjusting the brush roll, shown in Figs. 1 to 5, includes two opposed spring brackets **21**, which are rigidly fastened at their rear ends to the inner surface of the rug guard **11** and which extend forwardly beyond the axis of the brush roll **17**. Each of the brackets **21** is slotted horizontally to provide an upper spring finger **22** and a lower spring finger **23**.

The mechanism further includes a yoke **24** which serves to guide the brush for vertical movement. The yoke **24** includes a pair of opposed arms **25** having angular extensions **26** extending into a central tubular member **27**. A brush cap **28** of circular form and of slightly larger diameter than the brush roll body **18**, is rigidly attached to each arm **25**. The brush roll **17** is disposed between the brush caps **28** and is mounted on a pair of trunnions or bearings **29** which are rotatably carried by the brush caps in any suitable manner. Each of the brush caps may be provided with an inturned peripheral flange **30** extending over the end of the brush body **18** to minimize the possibility of threads or the like, picked up in the cleaning operation, getting entangled in the thrust bearings.

The yoke **24** is pivotally supported on the upper spring fingers **22** for rotation about a horizontal axis, disposed forwardly of the brush roll and parallel to the axis thereof. The yoke is preferably detachably pivoted, and to this end each of the spring fingers **22** is provided with an inwardly projecting pivot pin **31**, which is received in an appropriate aperture in the adjacent arm **25**. The yoke **24**, the brush caps **28** and the brush roll **17** comprise a unitary assembly, which may be detached from the spring fingers **22** by momentarily forcing the same outwardly to disengage the pivot pins **31** from the arms **25** of the yoke.

For vertically adjusting the position of the brush roll **17**, I provide an adjusting plate member **32**, which is of U-shape in plan view, as shown in Fig. 2. The member **32** has a broad curved plate portion **33** and opposite end portions or pads **34**. The member **32** is preferably made of sheet metal, and at its ends has flanges **35** extending upwardly from the pads **34**. The plate member **32** is preferably detachably pivoted to the lower spring fingers **23** by means of inwardly extending rivets **36** fastened to the spring fingers **23** and extending into apertures in the flanges **35**. Thus, the adjusting plate member is rotatable about the axis of the rivets **36**, which axis extends parallel to the brush axis and is disposed forwardly of and below the same. As shown in Fig. 5, the adjusting plate member is so formed and positioned that the pads **34** underlie and abut the brush caps **28**, while the plate portion **33** is movable away from and toward and into contact with the tips of the short bristles **19**. When the cleaner is not in operation, the weight of the brush roll **17** and the brush caps **28** urges the adjusting plate member clockwise, as seen in Fig. 1, the plate portion **33** being urged toward the brush and against the bristles.

The brush roll is driven by the motor shaft **14** by means of a resilient rubber belt **37** that engages a pulley **38** on the shaft **14** and a belt groove **39** formed in the brush body **18**. As shown in Fig. 4, the parts are pos-

tioned with the axes of the shaft 14 and the pivot pins 31 disposed in a plane below the axis of the brush roll, so that the center or axis of the belt tension imposed on the brush, indicated in Fig. 4 by the line 40, tends to move the brush roll downwardly. The centerline of the yoke 24, extending through the axis of the rivets 31 and the brush axis, is extended at 41 and is disposed at an angle *a* to the belt tension axis 40. The belt tension thus exerts a clockwise torque on the yoke 24 about the rivets 31, which urges the brush downwardly against the pads 34 of the plate member at all times, whether the suction cleaner is in operation or not.

Operation

In Fig. 1, the suction cleaner is shown in idle or starting position, with the brush roll 17 in new condition, that is, with its bristles unworn and at their maximum length. The weight of the brush roll and the brush caps, together with the downward force of the belt 37, urges the brush roll downwardly against the pads 34, moving the adjusting plate member 32 clockwise to bring the plate portion 33 into abutment with the ends of the stiff bristles 19, provided the brush roll is stopped in a position in which some of the bristles 19 are disposed adjacent the plate portion 33. If the brush roll stops in a position in which none of the short bristles 19 are disposed adjacent the plate portion 33, the brush roll is moved to a lower position, since the long soft bristles 20 yield against the pressure of the plate portion 33. However, in either case, as soon as operation of the cleaner begins, the brush roll is rotated (counterclockwise as shown in Figs. 1 and 4) so that the tufts or bristles 19 contact the plate portion with sufficient rapidity or frequency so that the adjusting plate member 32 positions the brush roll to provide the desired projection of the bristles below the air inlet opening.

Operation of the cleaner causes suction to be established within the nozzle 12 shortly after beginning operation. The suction causes air to be drawn in through the air inlet opening 16 and carrying with it dirt, lint and the like. The portion of the rug directly below the inlet opening 16 is drawn upwardly by the suction, as shown in Fig. 4. This portion of the rug engages the bristles 19 and, with most types of rugs, raises the brush roll above the position to which it is adjusted by the adjusting plate member 32, thereby permitting the plate portion 33 to be moved by the long soft bristles slightly out of contact with the ends of the bristles 19. In such case, the brush roll is supported on the rug and may be said to float thereon. It is thus positioned automatically by the rug during the operation.

As the outer ends of the bristles of the short stiff tufts 19 wear away, thereby shortening the bristles, the plate portion 33 may move further toward the brush roll, thereby permitting the plate member 32 to move in clockwise direction, as seen in Figs. 1, 2 and 4, and lowering the pads 34 and the brush roll 17, during idle and starting periods, so that the bristles of the tufts 19 will again project the desired distance, such as 1/32", below the mouth or inlet opening of the nozzle during starting periods. As shown in Fig. 2, for example, the bristles have worn to reduce the diameter represented by their ends to that indicated by the dot-and-dash circle 17', permitting the plate portion 33 to move to the dotted line position 33'. The pads 34 have been lowered to the dotted line position 34', lowering the axis of the brush roll so that, at the lower portion of the circle 17', the ends of the bristles are at the same height as when the brush was new.

In the first embodiment of the invention shown in Figs. 1 to 5, in which the plane containing the axes of the drive shaft 14 and the pivot pins 31 is disposed below the brush roll axis, if the adjusting plate member 32 were not provided, the brush roll might assume too low a position when the bristles 19 are new. They might hold the rug to such a low position that the rug would not engage the edges or lips of the nozzle inlet and, therefore, would not provide the seal necessary to establish adequate suction within the nozzle 12, which is necessary to hold the rug upwardly against the nozzle inlet as shown in Fig. 4. By the provision of the adjusting plate 32, the brush roll 17 is prevented from dropping down to such a low position, thereby assuring that the rug will be raised to provide a seal and establish suction, so that thereafter the position of the brush roll may, at least with many types of rugs, be determined by contact with the rug.

As the brush wears and moves downwardly, the angle *a* becomes progressively smaller. I prefer, however, that this angle be not reduced to zero, in order to retain a downward force from the belt tension. This may be achieved by locating the pivot pins 31 at a sufficiently low position, so that, after maximum downward movement of the brush roll due to wear, the brush roll axis will still be above a plane containing the axes of the rivets 31 and the drive shaft 14.

Fig. 6

In Fig. 6, I show a second embodiment of my invention in which the adjusting plate member is omitted. The brush roll 17 is mounted on support arms 25' that are pivotally mounted on pivot pins 31'. The rather strong tension of the reilient rubber belt 37 tends to lift the brush roll to a position in which its axis is in the plane containing the axes of the pins 31' and the shaft 14, but the weight of the brush roll lowers it somewhat from such position when the fan is not operating and somewhat stretches the belt 37. In this embodiment, the pins 31' are located at a suitable height, higher than the pins 31 of the first embodiment, such that the tips of the bristles 19 when new project the desired amount, for example, 1/32" or 3/64" below the mouth or inlet of the nozzle. Alternatively, the pins 31' may be located at a slightly lower position, and the downward movement of the brush roll limited by a stop. Such a stop may be provided, for example, by engagement of the brush roll caps 28 with the carpet guard 11.

In the operation of the cleaner shown in Fig. 6, the rug is drawn upwardly by the suction in the nozzle 12 against the edges or lips of the inlet 16, whereupon they provide a seal and increase the suction in the nozzle. The portion of the rug extending across the inlet is thus drawn upwardly against the tips of the bristles 19 to be subjected to the cleaning action thereof. Such portion of the rug, under force of the suction in the nozzle imposed thereon, moves the brush roll 17 upwardly by contact with the bristles 19, until equilibrium is reached between the upward force of the rug and the downward force of the brush roll. In some instances, depending particularly upon the type of rug, such equilibrium may be attained when the upward force of the rug is less than the weight of the brush roll, in which case it will move the brush roll upwardly until it balances that portion of the weight of the brush roll which is not counterbalanced by the tension of the belt 37. In such case, the brush roll axis is disposed below the plane containing the axes of the pins 31' and the fan shaft. In other instances, the upward force of the rug may be greater than the weight of the brush roll, in which case the brush roll is moved upwardly to a position as shown in Fig. 7 in which its axis is above the above-mentioned plane, in which the upward force of the rug is opposed by the weight of the brush roll and the downward effect or component of the tension of the belt 37. Thus, the brush roll is automatically positioned, vertically, relative to the portion of the rug that is being cleaned. In other words, the brush roll may be said to float on the rug.

As the bristles wear and become shorter, they will project to a less extent below the inlet 16 when the cleaner is not operating and, in operation, the rug will again be

drawn upwardly into contact with the tips of the bristles 19. The brush roll will again be automatically adjusted upon attaining equilibrium between the upward force of the rug and the downward force of the brush roll. Such equilibrium will be reached when the brush roll is in a slightly lower position and the rug will probably be in a slightly higher position. In any event, it has been found that the effectiveness of the brush roll remains substantially unimpaired as the bristles 19 become shorter due to wear.

In the operation of the cleaner shown in Figs. 6 and 7, the brush roll is free of vertical forces other than the weight of the brush roll including the brush caps and the arms 25', the tension of the drive belt 37, and the upward force of the rug or carpet bearing against the brush roll by reason of the suction in the nozzle 12. Thus, the brush roll is automatically adjusted by these forces to maintain it in the desired operative relation to the rug or carpet. Referring to the embodiment shown in Figs. 1 to 5, if the brush roll is raised by contact with the carpet to a position in which the plate portion 33 is moved out of engagement with the bristles 19, the brush roll is automatically adjusted by the same forces, except that it may be biased upwardly to a slight extent by reason of the soft bristles 20 striking the plate portion 33.

From the above description, it will be seen that I have provided a mechanism for automatically adjusting a brush roll vertically. Such adjustment compensates both for wear of the bristles of the brush roll, and also for the different characteristics of different types of rugs. While I have referred to the cleaning of rugs, it is to be understod that the mechanism is equally applicable to carpets and that the action is the same.

While I have shown my invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof.

What I claim is:

1. In a suction cleaner, the combination of a brush rotatable about a horizontal axis, means for guiding the brush for generally vertical movement, and a bell crank lever pivoted on an axis disposed below and to one side of the axis of said brush and comprising an arm extending upwardly and provided with a plate having a broad side movable into contact with the tips of the bristles of said brush and a second arm extending in a generally horizontal direction under said brush axis and supporting said brush, whereby said second arm moves said brush upwardly upon movement of said plate away from said brush and downwardly upon movement toward said brush.

2. In a suction cleaner, the combination of a nozzle, a brush roll within said nozzle and rotatable about a horizontal axis, means for guiding the brush roll for generally vertical movement, and lever means within said nozzle provided with a generally vertical upper plate portion having a broad side for contacting the bristles of the brush roll and a generally horizontal lower arm portion supporting the brush roll, said plate and arm portions being pivotally mounted and interconnected for synchronous movement in the same direction in such manner that said brush roll is moved upwardly by the lower arm portion upon movement of said upper plate portion away from the brush roll and is moved downwardly upon movement of the plate portion toward the brush roll.

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