Nov. 30, 1943. Q. BERG 2,335,377

SUCTION CLEANER

Filed Sept. 28, 1939 3 Sheets-Sheet 1

Fig. 1

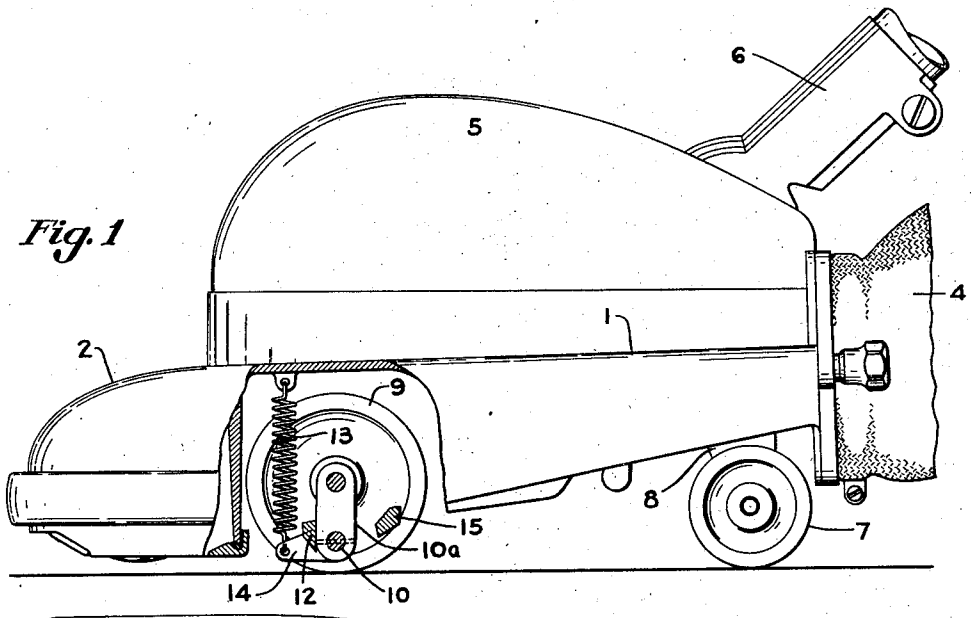
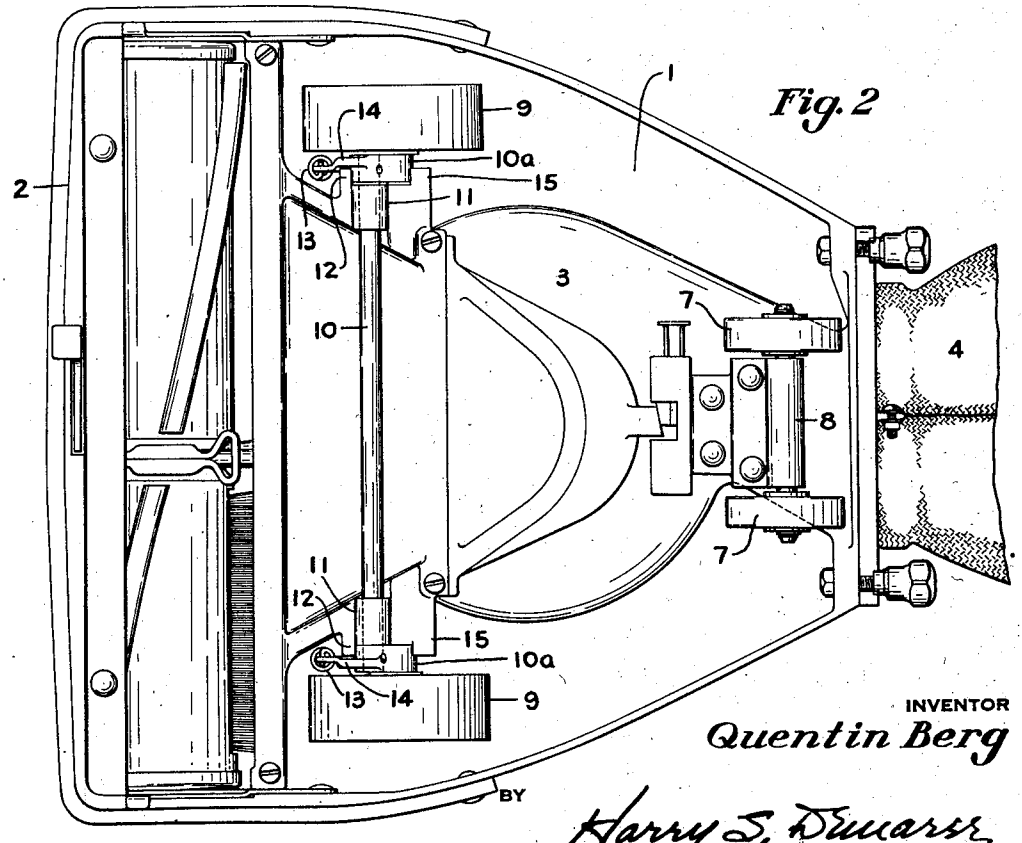


Fig. 2



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SUCTION CLEANER

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Fig. 3

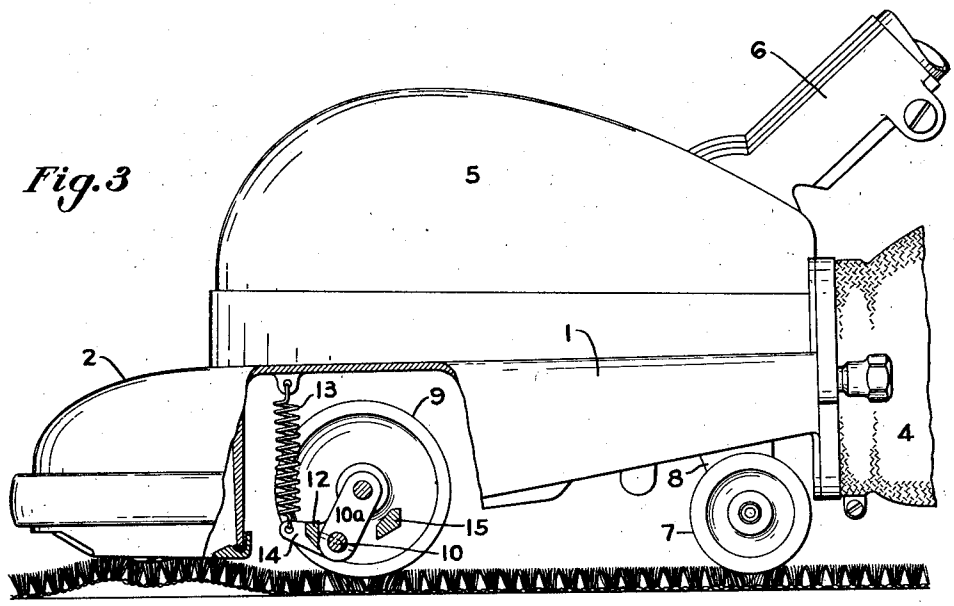
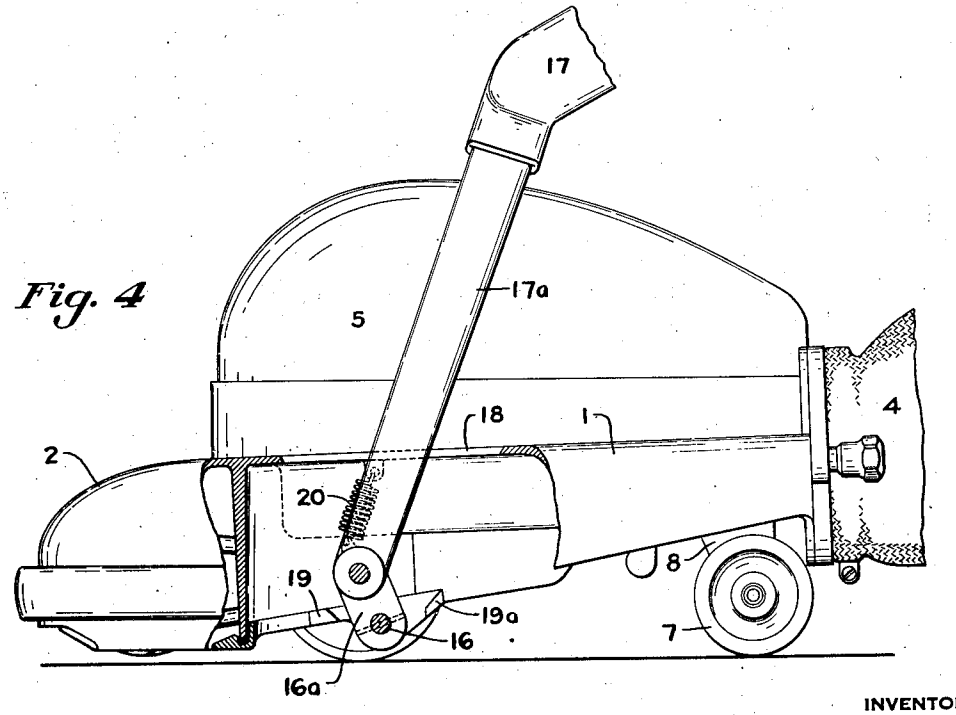


Fig. 4



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SUCTION CLEANER

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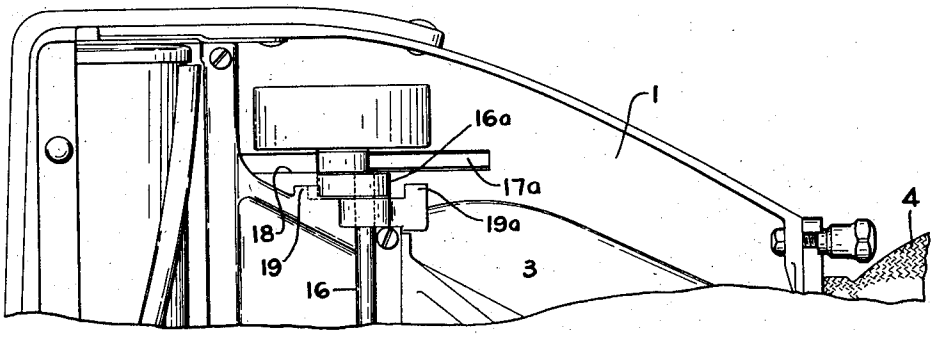


Fig. 5

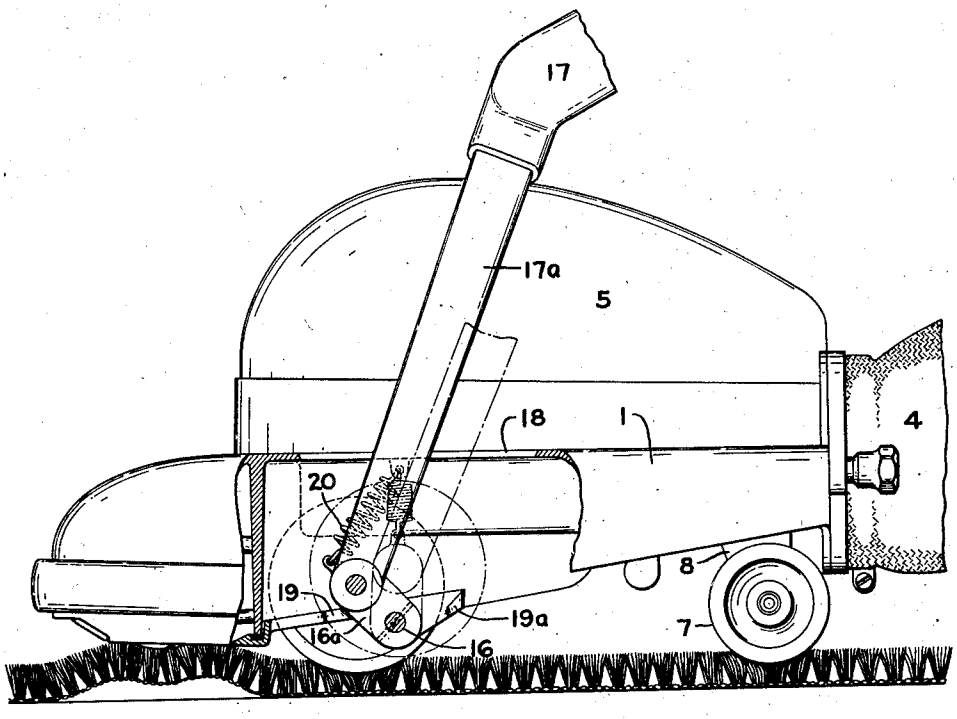


Fig. 6

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UNITED STATES PATENT OFFICE

2,335,377

SUCTION CLEANER

Quentin Berg, North Canton, Ohio, assignor to The Hoover Company, North Canton, Ohio, a corporation of Ohio

Application September 28, 1939, Serial No. 296,907

8 Claims. (Cl. 15—16)

This invention relates to improvements in suction cleaners and more particularly to novel means for maintaining the suction nozzle at the proper height above the carpet surface regardless of its quality and texture.

Various means have been devised for accomplishing this adjustment both manually and automatically, it being generally recognized that a correct nozzle height for every grade of carpet is essential to effective cleaning. The so-called automatic nozzle height adjustments now in commercial use have, for the most part, been built around auxiliary carpet contacting wheels which control the adjusting mechanism in accordance with the depth to which they penetrate or sink into the carpet, the depth of penetration in turn, being dependent upon the character and texture of the carpet nap.

The present invention also has for its object the maintenance of a proper and substantially uniform nozzle height regardless of carpet conditions, but attains its end by taking advantage of a factor that necessarily varies with different grades of carpet, namely, the resistance offered to the translatory or rolling movement of the cleaner during cleaning operation.

A preferred embodiment, as well as several practical modifications, of the invention have been disclosed in the accompanying drawings, in which:

Figure 1 is a general view in side elevation of a typical design of suction cleaner with portions broken away to show the manner in which the adjustable front supporting wheels are mounted upon the body;

Figure 2 is a bottom plan view of the cleaner;

Figure 3 is a view in side elevation similar to Figure 1 showing the front adjusting wheels shifted to raise the nozzle;

Figure 4 is a view in side elevation of a cleaner showing a modified arrangement of adjustable front wheels;

Figure 5 is a fragmentary bottom plan view showing the front wheel mounting of Figure 4;

Figure 6 is a view corresponding to Figure 4 but with the nozzle elevated.

The invention is applicable to any cleaner of standard design consisting of a body having a nozzle at its forward end, supporting wheels at front and rear, and a handle for maneuvering the cleaner backwardly and forwardly over the carpet surface. Therefore, the structural details of the cleaners herein disclosed are not of importance although the more essential parts may be identified by similar reference characters. The body 1 of the cleaner consists of a casing having a nozzle portion 2 at its forward end and housing the usual suction-creating means consisting of a motor-driven fan located within a fan chamber 3 and communicating with the nozzle and also with a rearwardly extending exhaust or discharge outlet opening into a dirt bag 4. The motor which drives the fan is housed within a cover 5 surmounting the casing 1. Each cleaner has a handle 6 pivotally mounted to swing forwardly and rearwardly, and in the case of the cleaner shown in Figures 1 to 3, inclusive, the handle is mounted at the extreme rear end of the casing 1.

The supporting wheels are preferably arranged in pairs beneath the front and rear of the casing 1, the rear wheels 7, 7 being preferably arranged in the form of a caster, being journalled upon a bracket 8 having fixed connection with the underside of the casing.

Now, referring to the arrangement of Figures 1 to 3, inclusive, the front wheels 9, 9 are positioned immediately to the rear of the nozzle portion 2, but unlike the rear wheels are eccentrically mounted at the ends of a transverse rock shaft 10 journalled in suitable bearings 11, 11 formed integral with the underside of the casing 1, as clearly shown in Figure 2. More definitely, the shaft 10 has radial crank arms 10*a*, 10*a*, fixed at each end and at the outer ends of these crank arms are stub-shafts on which the wheels are journalled. With the wheels thus supported, their axes, although coinciding with each other, are offset from the axis of the transverse rock shaft 10, the amount of offset or throw of the crank arms 10*a* being in the neighborhood of one and one-half inches for the average cleaner.

The rock shaft 10 assumes a normal position with the crank arms 10*a*, 10*a* projecting vertically upward, that is, with the axes of the wheels directly above the axis of the shaft, its movement forwardly beyond that position being limited by a pair of lugs 12, 12 forming stop-members just forwardly and slightly above the inner ends of the crank arms, as in Figure 1. Moreover, a pair of vertically arranged coil tension springs 13, 13 are fastened to the underside of the casing 1, just forwardly of the wheels 9, 9 and these springs are attached at their lower ends to short arms 14, 14, projecting forwardly at right angles from the inner ends of the crank arms giving them the shape of bell-crank levers.

Now, when a cleaner is maneuvered over a

floor surface or covering, there is always a certain resistance to its movement by reason of the nature of the contact between the supporting wheels and the surface being cleaned. For example, if the cleaner is being propelled over a smooth hard surface such as the bare floor, the resistance to its forward movement would be very slight and consequently there would be no displacement of the front wheels and hence no adjustment of the nozzle.

But if the same cleaner is operated upon a carpet of average thickness, there would be an appreciably greater resistance offered to the rolling movement of the wheels, due to their tendency to sink into the carpet, and it is this resistance that brings about the automatic adjustment of the nozzle.

But before explaining the nature of this adjustment, it should be explained that in the usual cleaner the nozzle is always set at a predetermined distance above the surface of the floor covering being cleaned, although this spacing may vary somewhat with the character of the floor covering and for the reason that the wheels tend to penetrate or sink into some carpets to a greater depth than into others, thus bringing the nozzle closer to the carpet surface than is desirable for effective cleaning. Thus, it is the sinking of the front supporting wheels into the carpet that must be compensated for if the correct nozzle height be maintained. And it is the crank-supported wheels at the forward end of the cleaner body reacting to the resistance offered by the carpet that brings about this adjustment automatically.

Now, assuming again that the cleaner is being operated upon a carpet or rug of an average texture and depth of nap, as in Figure 3, it will be apparent that as the cleaner travels forwardly, the resistance to the rolling movement of the wheels offered by the carpet acts on the crank-mounted front wheels, causing them to lag with the result that a slight clockwise rocking movement is imparted to the crank arms, thereby swinging the cleaner forwardly and upwardly and elevating the nozzle in direct proportion to the angular displacement of the crank arms.

It is preferred, however, to limit the angular displacement of the crank arms **10***a*, **10***a* by means of a pair of lugs **15**, **15** disposed rearwardly and in the path of the crank arms **10***a* to act as stop members, limiting their angle of movement to approximately 60 degrees.

It should be made clear in this connection that it would be quite practical to do away with both front and rear stop members **12** and **15** as well as the springs **13**, **13**, thus permitting the front wheels and the rock shaft **10** to swing freely. This would mean that there would be an adjustment of the nozzle during both forward and return strokes instead of during the forward or operating stroke only, although a possible objection to the suggested free movement of the wheels would be their unrestrained oscillation when the cleaner is lifted. Hence it is preferred to confine the bodily movement of the wheels to a relatively small angle, although it would be quite practical to increase the angle to 90 degrees or even 180 degrees. In fact, by shifting the stop members **12** forwardly and allowing more space for the rocking movement of the front wheels forwardly, the automatic adjustment of the nozzle would take place during the backward as well as the forward stroke.

In any case, the greater the depth and thickness of the nap of the particular carpet being cleaned, the greater will be the penetration of the front wheels and the greater will be the resistance offered to the rolling movement of the supporting wheels. This greater resistance will produce a greater relative displacement of the wheels and consequent raising of the nozzle by way of compensating for the depth to which the front wheels penetrate the carpet. Thus it follows that regardless of the particular type of floor covering to be cleaned, whether it be linoleum, a Wilton carpet, or a heavy chenille or a velvet carpet, the nozzle will be automatically adjusted to the particular surface being cleaned by an angular displacement of the front wheels, that is, proportional to the resistance offered by the particular surface being cleaned to their rolling movement.

A modification of the foregoing arrangement is shown in Figures 4 to 6, inclusive, wherein the front wheels are mounted upon the body of the cleaner in substantially the same manner as before, except that the rock shaft **16** is shifted rearwardly a short distance and the handle **17**, which previously was mounted near the rear end of the cleaner body, is now pivotally mounted on the ends of the crank arms **16***a*, **16***a* that support the front wheels. To make this change, it is necessary to provide a handle having an inverted U-shaped bail **17***a* which straddles the body of the cleaner with its ends passing through slots **18**, **18** in the casing and journalled on the outer ends of the crank arms just inside of the front wheels, as clearly shown in Figure 5. In fact, the ends of the bail are mounted on the same bearing pins that carry the front wheels.

Now, the slight rearward shifting of the rock shaft **16** and a forward shifting of the position of the front stop member **19** now makes it possible for the crank arms to swing forwardly as well as rearwardly from a normal vertical position and to this end the tension springs **20**, **20** are shorter than those previously used and are attached directly to the free ends of the crank arms **16***a*, **16***a* and to the cleaner casing at points directly above the rock shaft **16**. The rear stop members **19***a*, **19***a*, however, are shifted back a short distance so that the crank arms are now able to swing through angles of 45 degrees in both directions from their normal vertical positions, or through a total angle of 90 degrees.

With the handle thus mounted, it is apparent that the force exerted therethrough in maneuvering the cleaner is transmitted directly to the ends of the crank arms **16***a*, **16***a* and thence to the floor through the front wheels. In other words, the body of the cleaner is relieved entirely from the effect of the force exerted through the handle and this naturally introduces a somewhat different action although the ultimate result is about the same as before.

In the first place, with the force applied directly at the front wheels, the handle, crank shaft and front wheels constitute a two-wheeled truck supporting the forward portion of the cleaner body so that it is free to rock backwardly and upwardly as the cleaner is moving in a forward direction and in response to the resistance of the nozzle in sliding contact with the carpet and the rear wheels in rolling contact therewith.

Therefore, as the cleaner is propelled forwardly, as shown in Figure 6, the force exerted through the handle rocks the wheels bodily forward with an accompanying angular displace-

ment of the crank arms corresponding to the depth of penetration of the wheels into the carpet nap. This leaves the body of the cleaner free to swing bodily about the common axis of the handle and front wheels, under the action of the nozzle friction force, until the nozzle is raised sufficiently to reduce that force to a point at which it is balanced by the forces tending to lower the cleaner, primarily the cleaner weight. The nozzle friction characteristics can be determined by its design and of course the opposing forces are known.

Hence, in this arrangement, it is again the resistance to movement of a part of the cleaner over the surface that is directly responsible for the angular displacement of the crank arms and the automatic adjustment of the nozzle.

Thus, regardless of the particular adaptation of the invention, it is the relationship between the force required to propel the cleaner over a surface and the resistance offered by that surface to the bodily movement of the cleaner that determines automatically the height of the nozzle with respect to the particular surface covering being cleaned. And, since for all practical intents and purposes the resistance is proportional to the propelling force, the nozzle is maintained at a substantially uniform height regardless of the character or texture of the particular carpet being cleaned.

And having set forth the invention in two equally practical embodiments, but without limiting it to any particular one, I claim:

I claim:

1. In a suction cleaner, the combination of a body having a nozzle at its forward end, a shaft extending transversely of said body adjacent said nozzle and provided with crank arms at its ends, wheels journaled at the ends of said crank arms with their axes normally offset directly above the axis of said shaft, said crank arms being adapted to swing freely through a limited arc of angular displacement under the resistance offered by the carpet surface being cleaned to the movement of said cleaner thereover, whereby the wheels adjacent said nozzle are displaced vertically to adjust the height of the nozzle to the surface characteristics of the particular carpet being cleaned.

2. In a suction cleaner, the combination of a body including a nozzle at its forward end and front and rear supporting wheels, said front wheels being journaled on lever arms having pivotal mounting on said body at points located below the wheel centers and free to swing from a substantially upright position under the resistance offered by the floor covering to the movement of said cleaner through an angle of displacement calculated to effect automatically the adjustment of the nozzle to the particular floor covering being cleaned.

3. In a suction cleaner, the combination of a body including a nozzle at its forward end and front and rear supporting wheels, lever arms pivotally mounted on said body for a limited free swinging movement and carrying said front wheels with their axes offset above the axes of said lever arms, said wheels being shiftable bodily in the angular displacement of said lever arms in a direction opposed to the direction of movement of the cleaner to adjust automatically the height of the nozzle to the particular floor covering being cleaned, and tension means acting to aid in the angular displacement of said wheel carrying arms.

4. A suction cleaner comprising a body having a surface-contacting nozzle, spaced aligned wheels upon opposite sides of said body and spaced equally from said nozzle adapted to penetrate to different distances in various surface coverings, a crank shaft pivotally mounting said body on said wheels below the axis of said wheels for free pivotal movement, means to propel said cleaner, said body and said wheels being free to make instantaneous angular relative adjustments by the pivotal movement of said crank shaft under forces received by said nozzle and wheels from a surface covering undergoing cleaning and said propelling means.

5. A suction cleaner comprising a body having a nozzle adapted to make frictional sliding contact with a surface covering undergoing cleaning, supporting wheels upon opposite sides of the body and at the same distance from said nozzle adapted to make rolling contact with a surface covering undergoing cleaning, means connecting said wheels to said body for free pivotal movement about axes positioned below their axes of rotation, said wheels under the weight of said body being adapted to sink to different distances into different surface coverings undergoing cleaning, the resistance to rolling contact varying with the sink, and a handle connected to said body to propel said cleaner whereby said wheels are moved relative to said body by their rolling resistance to effect an adjustment in the height of said nozzle.

6. A suction cleaner comprising a body having a nozzle adapted to make frictional sliding contact with a surface covering undergoing cleaning, supporting wheels upon opposite sides of said body and at the same distance from said nozzle adapted to make rolling contact with a surface covering undergoing cleaning, means connecting said wheels to said body for free pivotal movement about axes positioned below their axes of rotation, said wheels under the weight of said body being adapted to sink to different distances into different surface coverings undergoing cleaning, the resistance to rolling contact varying with the sink, a handle connected to said body to propel said cleaner whereby said wheels are moved relative to said body by their rolling resistance to effect an adjustment in the height of said nozzle and spring means exerting a force to supplement the rolling resistance of said wheels.

7. A suction cleaner comprising a body having a nozzle adapted to make frictional sliding contact with a surface covering undergoing cleaning, supporting wheels adapted to make rolling contact with a surface covering undergoing cleaning, means connecting said wheels to said body for free pivotal movement about axes positioned below their axes of rotation, the frictional sliding contact of said nozzle over a surface covering varying with its contact therewith and the texture thereof, and a handle connected to said wheels at their rotational axes to propel the cleaner over a surface covering undergoing cleaning, said body being adjusted vertically by the frictional force received by said nozzle from a supporting surface acting through said pivotal axes and about the axes of rotation of said wheels.

8. A suction cleaner comprising a body having a nozzle adapted to make frictional sliding contact with a surface covering undergoing cleaning, supporting wheels adapted to make rolling contact with a surface covering under-

going cleaning, means connecting said wheels to said body for free pivotal movement about axes positioned below their axes of rotation, the frictional sliding contact of said nozzle over a surface covering varying with its contact therewith and the texture thereof, a handle connected to said wheels at their rotational axes to propel the cleaner over a surface covering undergoing cleaning, said body being adjusted vertically by the frictional force received by said nozzle from a supporting surface acting through said pivotal axes and about the axes of rotation of said wheels, and spring means acting to hold resistingly said wheels in a predetermined position.

QUENTIN BERG.