Feb. 7, 1939. B. C. BECKER 2,146,006

SUCTION CLEANER

Filed Sept. 28, 1936 3 Sheets-Sheet 1

Fig. 1

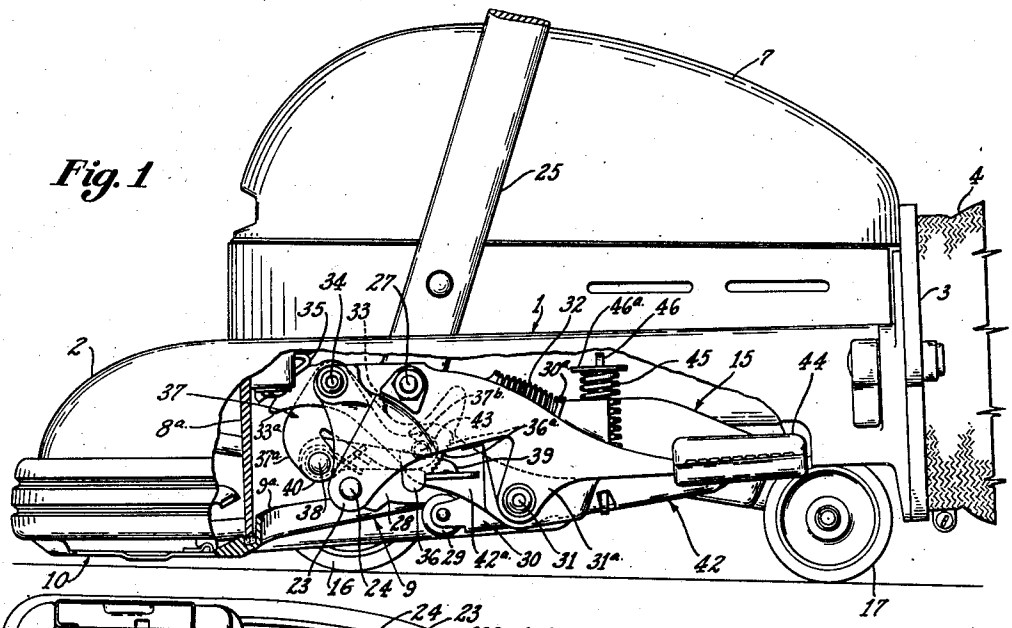
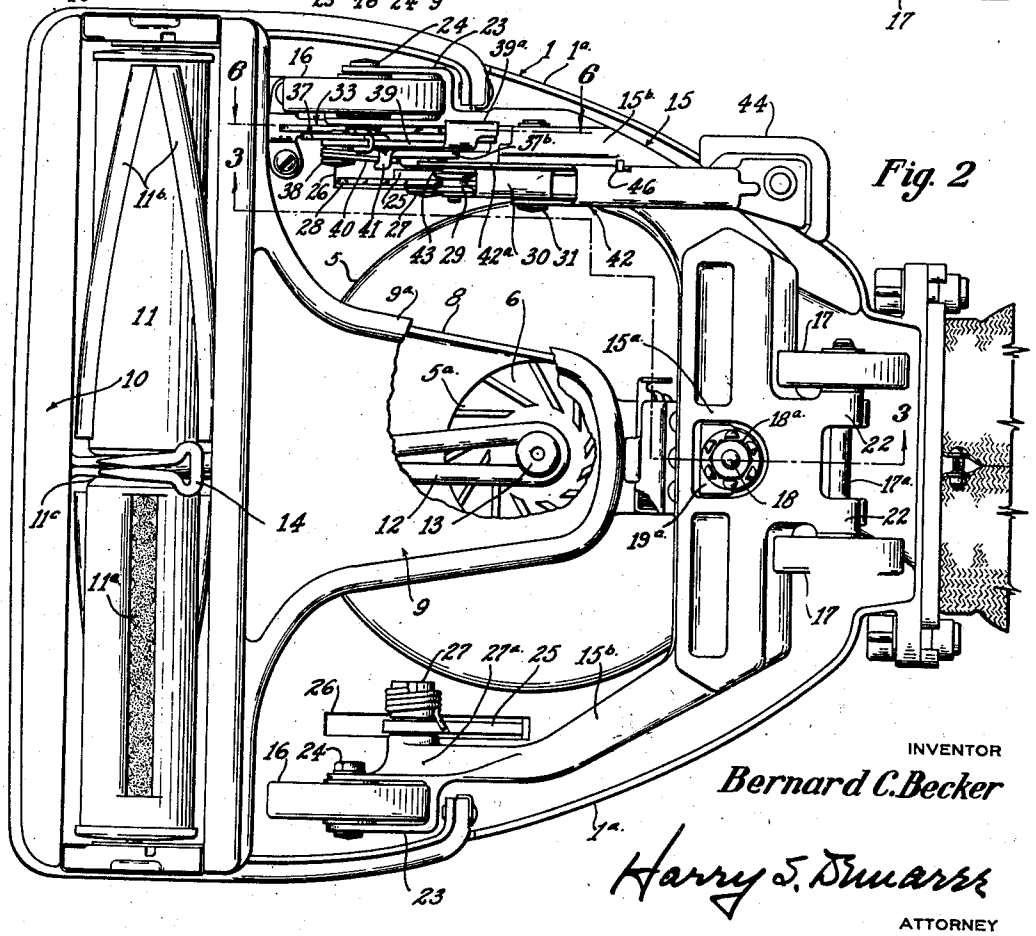


Fig. 2



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SUCTION CLEANER

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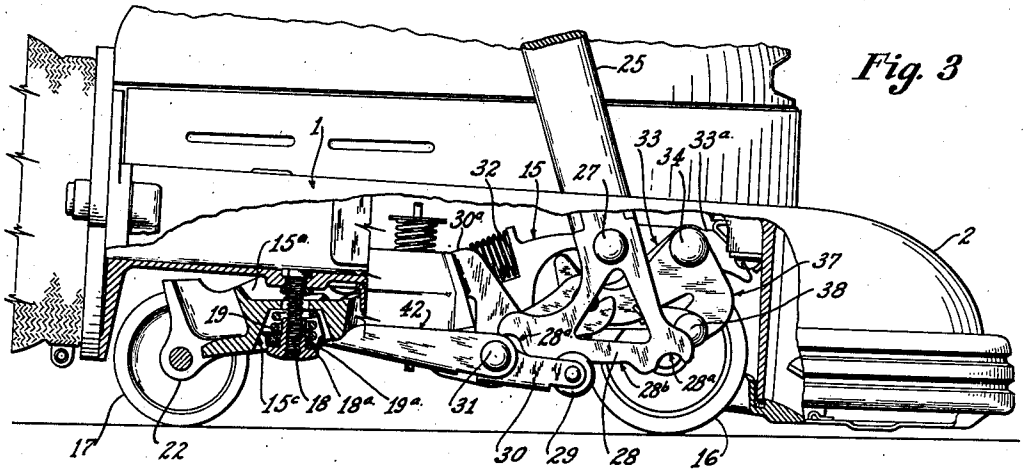


Fig. 3

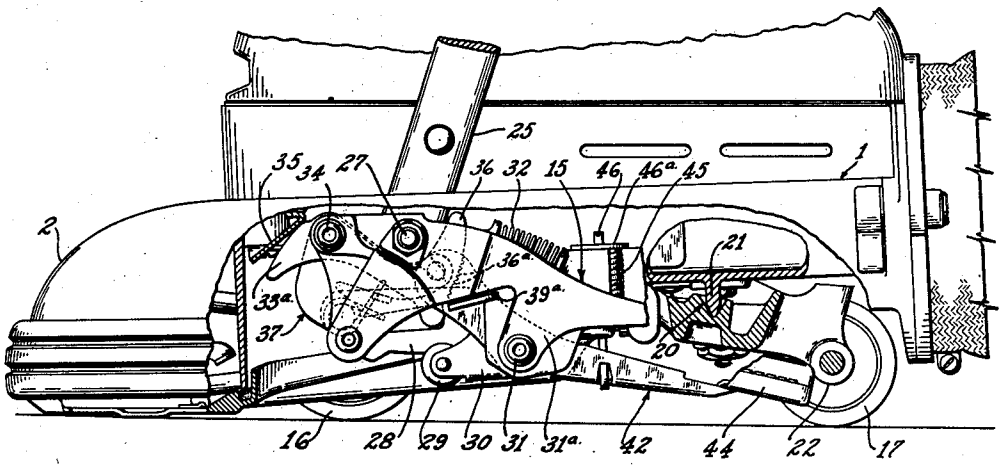


Fig. 4

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SUCTION CLEANER

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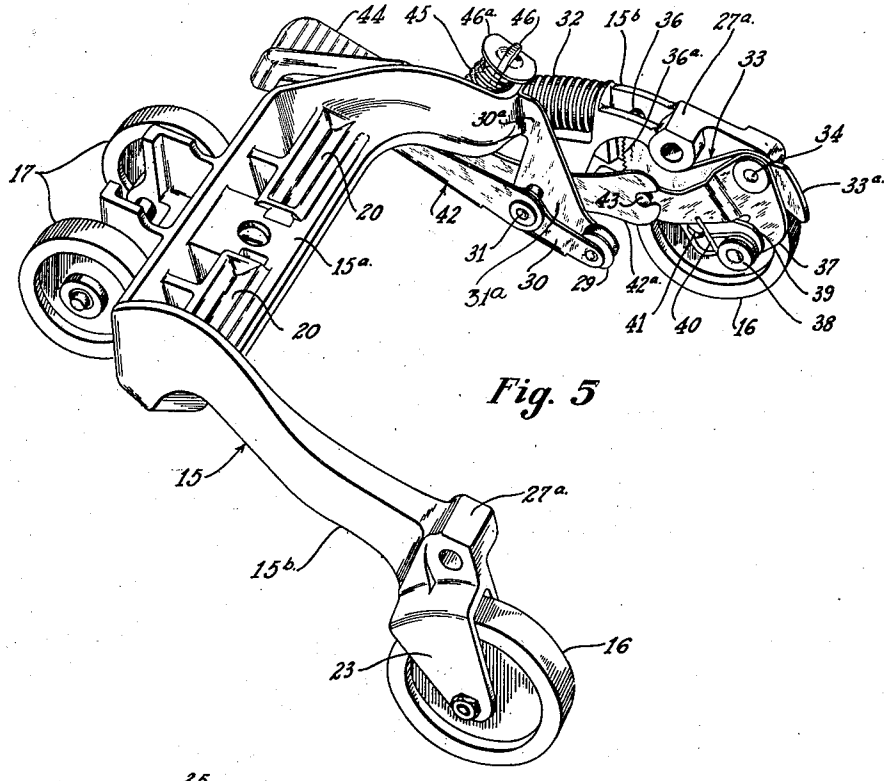


Fig. 5

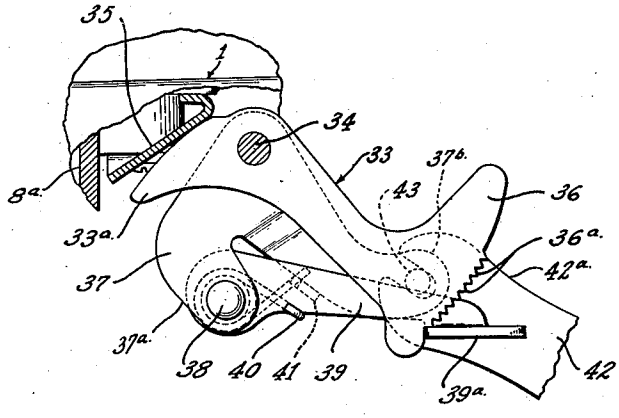


Fig. 6

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Patented Feb. 7, 1939 2,146,006

UNITED STATES PATENT OFFICE

2,146,006

SUCTION CLEANER

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Application September 28, 1936, Serial No. 102,883

15 Claims. (Cl. 15—16)

This invention relates to improvements in suction cleaners and more particularly to an adjusting mechanism for suction cleaners whereby the height of the nozzle may be promptly and properly adjusted to that best suited to the character of the particular floor covering to be cleaned.

It has been common practice heretofore to provide suction cleaners with nozzle height adjusting devices which are manually operated, as by the turning of a knob in one direction or the other, to raise or lower the nozzle to the height judged by the operator to be proper and according to an indicator which registers "high", "low" or "medium".

Were cleaners only operated upon bare floors or hard surface coverings, such as linoleum, no adjustment of the nozzle height would be necessary. But, since the greater part of the work is performed on carpets and rugs, the need for adjusting the height of the nozzle is essential to effective results, due primarily to the fact that there is more or less penetration of the supporting wheels of the cleaner into the carpet nap, depending on the length, thickness and texture of the pile and, in some but lesser degree, upon the resiliency, texture and weave of the backing or foundation of the carpet. Obviously then, there is a proper and correct nozzle height adjustment for each kind and grade of carpet or rug so that there is a possible range of adjustment from a bare floor to a very soft and thick velvet or Chinese rug. Consequently, while the average operator can approximate the proper change in nozzle height adjustment in passing from one type of floor surface covering to another, it is nevertheless largely a matter of guesswork, if, indeed, the adjustment is not neglected altogether because of the physical effort involved.

The primary object of the present disclosure is to provide a nozzle height adjusting mechanism which is automatic in its operation, to the extent that it sets or regulates itself to the particular character of the floor covering to be cleaned, although it does involve the manual operation of pressing down and then releasing a foot pedal. And in this connection, it should be pointed out that the broad concept of the present disclosure, constitutes the subject matter of a copending application filed August 15, 1936, and bearing Serial Number 96,222. Hence, a further object of the present invention is to incorporate certain improvements in the so-called automatic nozzle height adjusting mechanism among which may be mentioned one designated as the "compensating" feature, the nature of which may be briefly explained at this point:

The fundamental and distinctive feature of the automatic nozzle height adjustment is the provision of means whereby upon wheeling the suction cleaner onto any floor covering to be cleaned, the pressure of the foot upon an operating lever momentarily disengages the nozzle carrying portion of the cleaner from the supporting means, thus allowing the nozzle to drop into contact with the surface of the floor covering and which for the present may be assumed to be any ordinary grade of carpet. The nozzle, presenting a somewhat extended flat surface area, does not sink into or penetrate to any appreciable depth the nap or carpet pile, consisting as it does of a multiplicity of fine fibers and, as a consequence, the nozzle comes to rest in contact with the true carpet surface, namely, the tips of the upstanding fibers, whereas the supporting wheels of the cleaner penetrate into the carpet nap under the weight of the cleaner. Thus it follows that regardless of the type of carpet surface, the act of lowering the nozzle into contact with the floor covering, establishes a plane coinciding with that determined by the tips of the carpet fibers and it is from that plane that the correct height of the nozzle should be determined, regardless of the depth to which the supporting wheels may sink into the carpet. Thus, if the correct nozzle elevation is fixed at say $\frac{3}{32}$ inch, then this adjustment will be automatically established whenever the operator actuates the adjusting mechanism by successively depressing and releasing the foot pedal. And this is exactly what the adjusting mechanism of the previous disclosure accomplishes, namely, the elevating of the nozzle a fixed distance above the plane established by its contact with the carpet nap. But being a fixed adjustment, it cannot compensate for varying thicknesses or depths of nap in different carpets or rugs. To explain: It is apparent that the supporting wheels of a cleaner will sink into the nap of a soft thick piled carpet or rug to a much greater depth than they will into the nap of a thin and relatively short pile carpet and hence it follows, that in order to obtain the correct nozzle adjustment the amount of nozzle elevation must be greater in the case of a thick and soft piled carpet as compared to a relatively stiff and short nap carpet.

And it is this feature that is referred to as the so-called "compensating" type of automatic nozzle adjusting mechanism and marks the distinction between the present and the previous disclosure

wherein the elevation of the nozzle is fixed and constant regardless of the variations in the thickness of the carpet pile. And in this connection it might be added that in the average home and under ordinary conditions there may not be sufficient difference in carpet textures to make the compensating feature of vital importance. On the other hand, there are many homes and establishments where a wide variety of carpets and rugs are to be found and hence, for the correct and proper setting for the nozzle over a comparatively wide range of operating conditions, the compensating type of automatic nozzle adjustment is of a definite advantage.

With the foregoing introductory matter, a preferred embodiment of the invention will now be discussed in detail with reference to the accompanying drawings, in which,

Figure 1 is a general view in side elevation of a suction cleaner with a portion of its side wall removed to show the general assembly of the improved automatic nozzle height adjusting mechanism.

Figure 2 is a bottom plan view of the suction cleaner showing the supporting carriage for the cleaner casing and the nozzle adjusting mechanism associated therewith.

Figure 3 is a view in vertical section taken on line 3—3 of Figure 2, showing the adjusting mechanism in elevation from the opposite side.

Figure 4 is a view in side elevation corresponding to Figure 1 showing the nozzle in its lowered position in contact with the carpet surface and the nozzle height adjusting mechanism immediately prior to the releasing of the foot pedal from its depressed position.

Figure 5 is a perspective view of the supporting chassis removed from the cleaner and showing the assembly of the nozzle adjusting mechanism therewith, and

Figure 6 is a detail view in vertical section through a portion of the adjusting mechanism as taken on line 6—6 of Figure 2.

Referring to the cleaner in its general aspects, the same comprises a main casing 1, having a nozzle portion 2, extending transversely of its forward end and having the form of an elongated chamber with a downwardly facing opening. The casing extends rearwardly from the nozzle portion, gradually converging to a rearwardly opening flanged outlet connection 3 to which is attached a dirt receptacle in the form of a fabric bag 4. Centrally of the casing 1 is a circular fan chamber 5, visible from the underside thereof, (Figure 2) and enclosing a fan 6, having direct driving connection with a motor (not shown) enclosed within a domelike cover or hood 7 surmounting the casing 1. The inlet to the fan chamber has the form of a circular opening or eye 5a located centrally of its bottom wall and concentric with the vertical axis of the fan and its driving motor. Surrounding the rear half of the fan eye 5a and extending forwardly towards the nozzle portion 2, with a slight outward flare is a depending wall 8 curving abruptly through a right angle as it approaches the nozzle and forming the rear wall segments 8a, 8a, thereof at its outer ends. This depending wall forms the sides of a passage extending forwardly and communicating with the interior of the nozzle 2, said passage being closed at its bottom by a plate 9, having an upwardly facing marginal groove 9a bearing against the bottom edge of the wall 8 and suitably lined with a resilient material to form an air tight seal. This bottom plate 9 is shaped to conform with the outline of the wall 8, and preferably comprises as an integral part thereof, the bottom plate 10 which forms the suction mouth of the nozzle 2, consisting of narrow lips surrounding the elongated rectangular shaped mouth.

Within the nozzle chamber and immediately above the suction mouth is located a rotating agitator 11, consisting of a cylindric shell having brush elements 11a, 11a, arranged lengthwise thereof and helically arranged beater elements 11b, 11b. The bottom plate 9 is removable to uncover the nozzle chamber and the passage leading rearwardly therefrom, for access to the agitator as well as a drive belt 12 for the agitator enclosed within the passage from the nozzle chamber to the fan chamber and extending from a pulley 13 carried at the lower end of the fan shaft to a pulley groove 11c midway between the ends of the agitator 11 and protected by a guard member 14, extending transversely of the suction mouth, as clearly shown in Figure 2.

Again referring to the main casing 1, with its centrally disposed circular fan chamber 5, it will be noted that along the edges of the casing and extending rearwardly from the ends of the nozzle 2 are depending curvilinear walls 1a, 1a, and between these depending marginal walls and the side walls of the fan chamber 5, are cavities or hollow spaces which have a depth substantially equal to the height of the casing 1 itself. It is within these cavities and enclosed by the marginal side walls 1a, 1a, of the casing, that are located the wheeled support for the casing and the nozzle adjusting mechanism associated therewith.

Referring first to the supporting means for the cleaner, the same comprises a U-shaped chassis or carriage 15 carrying a pair of front carrier wheels 16, 16 located just inwardly from the sides of the casing 1 and immediately to the rear of the nozzle portion thereof and a pair of rear wheels 17, 17 having more the character of a two-wheeled caster located beneath the rear end of the casing. The carriage or chassis 15 has pivotal connection with the casing just forwardly of the rear caster assembly whereby the cleaner body is enabled to tilt about a horizontal axis and the nozzle portion thus raised or lowered with reference to the floor level. And also, there is the automatic adjustable connection between the forward end of the chassis and the casing, including a foot operated pawl and ratchet mechanism, which functions to bring about the desired tilting of the cleaner body on the wheeled chassis to maintain the correct elevation of the nozzle above the carpet surface.

Referring particularly to the form and mounting of the chassis or carriage 15, it has the form of a U-shaped casting disposed symmetrically beneath the cleaner casing 1 with its base portion 15a extending transversely at the rear of the casing and its two arms or branches 15b, 15b extending forwardly within the cavities formed between the outer marginal side walls 1a, 1a and the circular outer wall of the fan chamber 5. A pivot bolt 18 depends vertically from the bottom wall of the fan chamber 5 enters a downwardly facing socket 15c at the center of the base portion 15a of the chassis frame 15. A nut 18a mounted at the lower end of the pivot bolt 18 supports a coil spring 19 with its retaining collar 19a, said spring surrounding said pivot pin and bearing against the upper end of the socket 15c, forms a somewhat resilient pivotal or swivel connection between the cleaner casing 1 and the

U-shaped wheeled chassis 15, as clearly shown in Figure 3.

However, in order to limit the movement between the cleaner casing 1 and the chassis 15, a pair of upwardly facing V-shaped channels 20, 20 are formed in the upper face of the central or base portion 15a and on opposite sides of the bolt receiving socket 15c and engaged by corresponding knife-edge projections or flanges 21, 21 cast integral with the cleaner casing and depending from the under surface of the fan chamber. Manifestly, the combination of the spring bolt connection and the knife-edge flanges rocking in the V-shaped channels in the chassis frame affords a solid and substantial mounting for the casing and yet permits the necessary tilting for obtaining the desired nozzle adjustment. And extending rearwardly from the base portion 15a of the chassis frame 15, is a pair of spaced arms 22, 22 which form a supporting bracket for an axle 17a on which are journaled the rear wheels or casters 17, 17.

Now, following the forwardly extending arms 15b, 15b of the chassis frame 15, outwardly to their forward ends it will be noted, as shown in Figure 2, that they terminate just rearwardly of the nozzle 2, in the form of downwardly and forwardly extending fork members 23, 23, supporting at their lower end, bearing shafts 24, 24 on which are journaled the front carrier wheels 16, 16.

Carried by the chassis 15 just rearwardly of and above the front wheel supporting members 23, 23 is an inverted U-shaped bail member 25 which forms the lower extremity of the handle of the cleaner and, straddling the dome-like cover 7, projects through longitudinal slots 26, 26 in the top wall of the casing 1 with its ends pivotally mounted on bearing pins 27, 27 supported by bosses 27a, 27a, formed integral with the end portions of the chassis frame 15 and projecting laterally and inwardly therefrom (Figure 5). Thus the cleaner handle is carried by the wheeled chassis and quite independently of the casing 1.

Associated with the handle bail 25 and mounted adjacent the end of one of the arms 15b of the chassis frame 15, is a handle position control device which serves to restrain the handle from free swinging movement and to define its extreme positions as well as its intermediate or working range. This device is already in common use, except that in its present application, the action is between a cam sector carried by the handle bail and a spring pressed roller mounted on the chassis instead of on the cleaner casing. Thus, as clearly shown in Figure 3, the cam sector 28 is fixed to the end portion of the handle bail 25 on the same side of the cleaner as the nozzle adjusting mechanism, said sector projecting below the bail end pivot and having along its arcuate lower edge three notches, the endmost notches 28a being semi-circular in shape and the intermediate notch 28b being somewhat elongated. Now bearing edgewise against the notched edge of the sector 28, is a cam roller 29 carried at the free end of a bell crank lever 30 journaled on a pivot pin 31 supported at the lower extremity of a depending web 31a integral with the chassis frame 15, Figure 4. The upwardly projecting arm 30a of the bell crank lever 30, forms an abutment for one end of a compression spring 32, suitably supported on the chassis frame 15. Manifestly, the spring acting through the lever 30, holds the roller 29 against the edge of the control sector 28, so that while it is possible to shift the handle from one position to another quite readily, the spring-pressed cam roller 29 holds the handle in that position.

Referring now to the improved nozzle height adjusting mechanism, attention is first directed to the fact that as thus far described the body of the cleaner is pivotally connected to its chassis with only the weight distribution to hold the nozzle from being tilted. But with the introduction of an adjustable supporting member between the two, the raising and lowering of the nozzle is accomplished.

This adjustable supporting member is carried by the carriage 15 and consists of a somewhat irregular shaped ratchet lever 33 pivotally mounted on a bearing pin 34 carried at the forward and upper edge portion of the left hand arm 15a of the chassis, as viewed in Figure 2. Projecting beyond its pivot, this lever terminates in a pointed or wedge-shaped cam member 33a, which presents an inclined cam face having bearing contact with a correspondingly inclined abutment plate 35 extending diagonally of the corner angle formed at the junction of the top wall of the casing 1 and the vertical rear wall segment 8a of the nozzle chamber. This abutment plate 35 is preferably provided with a flat cam face having contact with a slightly convexed cam member 33a at the upper end of the ratchet lever 33, but as presently will be seen the angularity and contour of these cam faces may be varied, depending on the desired vertical displacement of the casing during a given angle of rocking movement of the lever. Thus it may be assumed for the purpose of this discussion that the weight of the cleaner body is transmitted to the chassis through the abutment plate to the lever 33 and thence to the chassis, and that by rocking said lever 33, the action of the cam member 33a raises or lowers the forward or nozzle end of the casing 1.

Continuing the description of the ratchet lever 33, the same extends in a general downwardly and rearwardly inclined direction from its pivot pin 34 and as it approaches its rear end, diverges abruptly into a ratchet sector 36 having somewhat the shape of a fish tail with a slightly curved edge in which are cut a series of ratchet teeth 36a.

Also pivotally mounted on the same pin 34 that supports the ratchet lever 33 upon the chassis, is another somewhat irregularly shaped lever 37 having somewhat the characteristics of a lever of the bell-crank type. From its point of pivotal mounting on the pin 34, this second lever 37 has a forwardly disposed arm 37a which extends in a general downward direction and another arm 37b also extending downwardly, but in a more rearwardly direction with a slight upturn at its extremity.

Referring to Figures 1 and 2, it will be noted that the forward depending arm 37a of the bell crank lever 37 lies just inside of the ratchet lever 33 and that at its lower end supports a pivot pin 38 on which is journaled a pawl lever 39 extending rearwardly therefrom in a substantially horizontal direction. This pawl lever 39, the ratchet lever 33 and the bell crank lever 37 are all stamped from sheet metal and oscillate in parallel vertical planes. However, the rearmost arm 37b of the bell crank lever 37 is offset laterally inward from its other and forward arm 37a, with the result that the two portions of the bell crank lever 37 actually straddle the pawl lever 39, as shown in Figure 6. Returning to the pawl lever 39, its outer and free end which extends a

short distance beyond the toothed edge of the ratchet sector **36** of the lever **33** and at its extreme end is provided with a dog **39***a* projecting from its lower edge laterally, at right angles to the toothed edge of the ratchet sector **36**, with which it is adapted to have a pawl and ratchet connection.

Acting on the pivoted pawl lever **39** is a torsion spring **40** which is coiled around an enlarged bearing portion of the pivot pin **38** and having straight end portions which cross each other at right angles, the uppermost end being caught by a hooklike lug **41** on the lower edge of the lever **37** and the other end terminating in a hooked extremity engaging the lower edge of the pawl **39**. The torsion spring **40** thus exerts a constant force upon the pawl lever tending to swing it upwardly and in a counterclockwise direction and the dog **39***a* at its free end upwardly and away from the toothed edge of the ratchet sector **36**. The actual movement of the pawl lever **39** however, is very limited; in fact, its extreme swinging movement is confined to an arc of a few degrees, as will be seen by comparing Figures 1 and 4, wherein the dog **39***a* strikes the underside of the chassis **15** to limit upward movement of the pawl lever **39**.

Now, with the pawl dog **39a** engaging the ratchet sector **36**, it follows that the levers **37** and **33** become united and oscillate together, and if movement is imparted to the bell crank lever **37** while so connected with the ratchet lever **33**, this movement will be transmitted to the casing **1** through the rolling contact between the edges of the wedge shaped cam member **33***a* of the ratchet lever **33** and the inclined abutment plate **35** on the casing **1**.

Now, the bell crank lever **37** is the primary moving member of this combination of interconnected levers and to which a limited oscillating or rocking movement is imparted through a foot actuated operating lever **42** pivotally mounted intermediate its ends on the same bearing pin **31** that supports the handle position control lever **30**. The forward and shorter arm **42***a* of the operating lever is provided with a bifurcated or forked extremity which has pivotal connection with a pin **43** carried at the end of the rearwardly extending lever arm **37***b* of the bell crank lever **37**, from its point of pivotal mounting on the under side of the chassis **15**, the other arm of the operating lever **42** extends rearwardly and is provided at its extremity with a foot pedal **44** projecting laterally and outwardly from beneath the depending marginal wall **1***a*, of the cleaner casing **1** as clearly shown in Figure 2. The operating lever **42** normally assumes a horizontal position being held against depression by means of a coil spring **45** of the compression type carried by the chassis and mounted in vertical position with a connecting rod **46** extending axially through the spring and connected at its lower end with the operating lever and its upper end with an abutment plate **46***a* bearing upon the top of the spring. Thus the depression of the operating lever **42** is opposed by the spring **45** which also acts to return the lever to its normal horizontal position when the pressure of the foot is removed after the same has been depressed to its lower limit.

The foregoing description completes the structure of the cleaner insofar as it pertains to the wheeled supporting chassis for the cleaner casing and the nozzle adjusting mechanism, the operation of which will now be described:

Referring to Figure 1, it may be assumed that the cleaner has been properly adjusted as to nozzle height for a particular carpet or floor covering and is about to be readjusted for another and a different grade of carpet to be cleaned. Naturally, the carriage or chassis **15** rests upon the carpet with the wheels sinking into the surface somewhat, the casing **1** assuming a slightly forward tilted position with the nozzle elevated a definite distance above the carpet surface.

Now, the position of the nozzle, it is to be noted, is determined by the point at which the cam **33***a* contacts the abutment plate **35**. But it should be noted also that the actual distance the nozzle will be elevated is dependent on two variable factors, first, the angular displacement of the cam member **33***a* during a given adjusting operation and second, the point along the edge of said cam member where contact takes place with the rounded or convex bottom edge of the abutment web **35**, at the commencement of the adjusting operation. Manifestly, then, if the ratchet lever **33** is rocked, the angularity of the contact edge of the cam **33***a* will be changed and again, if there is any appreciable displacement between the casing and the chassis there would be a corresponding shifting of the point of contact between these cam faces and the differential of these variable factors produces a third variable, namely, the distance the nozzle will be displaced from the chassis during any adjusting operation.

This will be better understood from the following description of the part which the several levers play in the adjusting operation: Any given position of adjustment such as that shown in Figure 1, will illustrate the relative positions of the parts at the beginning of an adjusting operation. In the first place, it will be noted that the pawl lever **39** under the tension applied to it by the torsion spring **40** is held in toothed engagement with the ratchet sector **36** and since the pawl lever is carried by the bell crank lever **37** and the latter held against the movement by the operating lever **42** and its spring **45**, it follows that a constant nozzle height adjustment will be maintained as long as the relative positions of the various parts of the adjusting mechanism are not altered.

But let it be assumed that the cleaner is moved onto another and a very different type of carpet surface and hence a readjustment of the nozzle height is necessary. To accomplish this the operator merely depresses the foot lever **42** to its lowermost position as shown in Figure 4, and then releases it whereupon it is returned to its normal position by the spring **45**. But during the downward stroke of the operating lever, several movements take place and these will now be considered in their order or sequence:

First of all, the depression of the foot lever **42** transmits a rocking movement to the bell crank lever **37** in a counter-clockwise direction until the dog **39***a* strikes the underside of the adjacent forwardly extending side arm **15***b* of the chassis **15** and thus holds the pawl lever **39** against further upward movement. But in the continued movement or oscillation of the bell-crank lever **37**, the pawl lever is shifted endwise and in a rearward direction thereby effecting the disengagement of the ratchet sector by the pawl dog **39***a*. This displacement of the pawl lever **39** releases the ratchet lever **33** leaving the latter free to oscillate under the weight of the cleaner casing exerted upon the cam member **33***a* at its forward end and, with the release of the ratchet sector **33**, the cleaner casing tilts forwardly by gravity until

the nozzle rests upon the carpet nap, that is, the surface defined by the tips of the upstanding carpet fibers, since as already explained, the area of the lips surrounding the nozzle opening is sufficiently large to prevent the appreciable penetration of the nozzle into the carpet pile. Now, all of this action takes place during the depression of the foot pedal and while it is being held momentarily in depressed position by the operator's foot, meantime the parts of the adjusting mechanism assuming the positions shown in Figure 4 until the foot lever is released.

Now, at this point let it be assumed that the carpet to which the nozzle height is to be adjusted, is considerably thicker than that on which the cleaner had been previously operating, that is to say, the nap of the carpet is considerably deeper and more than that, the carpet fibers are considerably softer. This means of course, that the supporting wheels of the cleaner would sink into the nap of the carpet to a considerably greater depth than they did into the nap of the carpet which had previously been operated upon, from which it follows that the initial position of the nozzle would be much closer to the surface of the softer, thicker piled carpet than it was on the harder and shorter piled carpet. In other words, the nozzle height adjustment proper for the first carpet is entirely improper for the carpet upon which the cleaner is about to be operated.

Thus, it is because the supporting wheels of a cleaner sink to a greater or lesser depth into the carpet nap depending upon the kind and texture of a particular carpet or rug, that it is necessary to compensate for this difference in wheel penetration by correspondingly varying the height of nozzle elevation. And this is exactly what takes place upon the completion of the adjusting operation by the release of the foot lever **42**. Now, to understand exactly what takes place, it should be first explained that due to the pivotal connection of the cleaner casing with its chassis, the relative movement between the nozzle and the carriage is not so much a vertical displacement as a tilting of the cleaner casing about its pivotal mounting on the carriage, although for convenience this relative movement may be assumed to follow a straight line tangent to the arc describing the actual movement and inclined at an angle of substantially 20 degrees to the vertical.

However, there is no actual parting of the casing from the chassis, the movement therebetween being the result of the cam **33***a* carried by the chassis rolling along the abutment plate **35** on the casing.

Now, with this relationship in mind let it again be noted that for the previous nozzle height adjustment, the contact between the cam **33***a* and the abutment plate **35** was determined by the angular position of the ratchet lever **33**, which in turn was governed by the particular ratchet tooth **36***a* engaged by the pawl **39***a*. But having transferred the cleaner onto another and entirely different type of carpet, the depressing of the foot lever **42** allows the nozzle to be lowered into contact with the carpet surface but not to the same extent that it was during the previous adjustment, due to the fact that the pile of the carpet is much thicker and hence the nozzle is brought to rest at a somewhat higher level than previously.

Now, due to the obliquity of the line indicating the direction of the relative movement between the casing and the chassis, the tilting movement of the casing when released by the depressing of the operating lever is translated into the lengthwise rolling contact between the two contacting faces of the abutment plate **35** and cam **33***a* from a point near the tip end of the cam inwardly toward the base of said cam. But the point at which these cam surfaces meet at the end of their rolling contact will not be the same as it was during the preceding adjusting operation because the nozzle is not lowered to the same extent that it was during the previous adjustment, and since the ratchet lever is free to swing with the lowering of the nozzle, it follows that the point of contact between the two cam surfaces when the nozzle has come to rest on the carpet, will be farther removed radially from the axis of rotation of the ratchet sector than it was to the commencement of the previous readjusting operation. As a consequence, therefore, a different portion of the slightly convex edge of the cam **33***a* will have rolling contact with the edge of the abutment plate **35** during the elevation of the nozzle and since the curvature of the convex edge of the cam **33***a* becomes increasingly pronounced as it extends outwardly and is eccentric to the pivotal axis of the ratchet sector, the displacement of the nozzle will vary with the arc of contact between the two cam surfaces during each adjusting operation.

This will be evident by considering the positions of the various parts as shown in Figure 4, and assuming again that the parts have momentarily come to rest after the nozzle has been lowered into contact with the carpet surface. Immediately the foot lever begins its upward stroke, the bell crank lever **37** swings downwardly and forwardly in a clockwise direction, this in turn imparting an endwise shifting movement to the pawl lever **39** carrying its dog **39***a* bodily forward and into contact with the toothed edge of the ratchet sector **36**. Now, the particular tooth which is engaged by the pawl will not be the same one from which it was released at the commencement of the preceding adjusting operation, because the ratchet sector has in the meantime been rocked or oscillated into a different angular position, and which has been determined by the position of the nozzle in contact with the carpet surface. And finally, having engaged the pawl **39** with the ratchet sector **36**, the continued oscillation of the bell crank lever **37** carries the ratchet lever **33** with it throughout the remainder of the movement imparted to it by the return stroke of the operating lever **42**, this oscillating or rocking movement of the ratchet sector being translated into a rolling contact between the two cam surfaces which not only imparts a lifting movement to the casing but controls the distance that the nozzle comes to rest above the surface of the carpet. Obviously this control, entirely automatic in its action, is attributable wholly to the location of the point of contact between the two cam surfaces at the commencement of the elevating movement of the nozzle since it is this "starting" point that determines the angularity of the arc of rolling contact and hence the ensuing "lift" of the nozzle.

Obviously, it is possible to increase or decrease the amount of the nozzle elevation by varying the angularity of the cam edges or by redesigning or altering the various parts of the mechanism so that the ratchet lever **33** will oscillate through a smaller or greater arc without changing the stroke of the operating lever. Consequently, the particular details of design of the present disclo-

sure may be variously modified without departing from the spirit of the invention.

I claim:

1. In a suction cleaner having a casing provided with a nozzle and a wheeled support adjustable relatively to said casing, means for lowering said nozzle into contact with the floor covering and subsequently elevating the same automatically above the surface thereof, and means acting automatically to vary the elevation of said nozzle in direct proportion to the depth said support sinks into the floor covering.

2. In a suction cleaner having a casing provided with a nozzle and a wheeled carriage having pivotal connection therewith, said casing being tiltable on said carriage for regulating the height of said nozzle above the floor covering to be cleaned, means for normally supporting said casing in a predetermined position of nozzle adjustment, mechanism operative to lower said nozzle into contact with the surface to be cleaned and thence to elevate the same automatically to a predetermined height above said surface, and means associated with said nozzle height adjusting mechanism to compensate for the penetration of the wheels of said carriage into the covering to be cleaned.

3. In a suction cleaner having a casing provided with a nozzle and a wheeled support pivotally mounted on said casing, and means for adjusting the height of said nozzle above the carpet surface, comprising operator actuated mechanism operative to lower said nozzle into contact with the carpet surface and thence to raise said nozzle automatically to a predetermined height above said surface, and means associated with said elevating mechanism for automatically compensating for the depth of penetration of the wheeled support into the nap of said carpet.

4. In a suction cleaner having a casing provided with a nozzle and a wheeled suport pivotally connected therewith for relative vertical adjustment, a shiftable member carried by said support and normally supporting said casing at a predetermined nozzle height and adapted to be actuated to lower said nozzle into contact with the surface of the floor covering and thence automatically to elevate said nozzle to a predetermined height above said surface, and means coacting with said shiftable member to increase the subsequent elevation of said nozzle in direct proportion to the depth said wheeled support penetrates the surface of the floor covering.

5. In a suction cleaner having a casing provided with a nozzle and a wheeled support pivotally connected therewith for relative vertical adjustment, a shiftable cam member carried by said wheeled support and operative to raise and lower said nozzle, means normally acting to maintain a predetermined nozzle height adjustment and adapted to actuate said cam member to permit said nozzle to be lowered into a contact with the carpet surface and thence to be elevated automatically to a predetermined distance above said surface, and means for automatically varying the elevation of said nozzle in direct proportion to the depth of penetration of the wheeled support into the nap of said carpet.

6. In a suction cleaner having a casing provided with a nozzle and a wheeled support having pivotal connection with said casing, and means for adjusting said casing relative to said support to vary the height of the nozzle above the carpet surface, comprising a lever pivotally mounted on said wheeled support and having a cam contacting an abutment on said casing, said lever being operative in one direction to lower said nozzle into contact with the carpet surface from a given position of adjustment and in the opposite direction to elevate said nozzle automatically to a predetermined height above said carpet surface, and means acting automatically to shift said cam and abutment relative to each other to increase the elevation of said nozzle in direct proportion to the depth the wheeled support penetrates the carpet nap.

7. In a suction cleaner having a casing provided with a nozzle and a wheeled support having pivotal connection with said casing, and means for adjusting said casing relative to said support to vary the height of said nozzle above the carpet surface, comprising a lever pivotally mounted on said wheeled support and having a cam adapted to contact an abutment on said casing, means normally locking said lever in a stationary position of casing adjustment, means for releasing said lever to permit said nozzle to drop into contact with the carpet surface and for subsequently raising said nozzle automatically to a predetermined height above said carpet surface, said cam being shiftable bodily with respect to said abutment and having a predetermined contour whereby the elevation of said nozzle is governed by the point of contact of said cam with said abutment at the commencement of the nozzle elevating movement.

8. In a suction cleaner having a casing provided with a nozzle and a wheeled support for said casing having pivotal connection therewith, and means for adjusting the height of said nozzle above the surface of the carpet to be cleaned, comprising a ratchet sector pivotally mounted on said wheeled support and normally supporting said casing from beneath through the medium of a cam contacting an abutment plate on said casing, an operating lever pivotally mounted on said wheeled support adjacent said ratchet sector, a spring-pressed pawl operatively connected with said operating lever and normally engaging said ratchet sector to support said casing, said operating lever being adapted to be actuated to disengage said pawl and ratchet sector to permit said nozzle to drop into contact with the carpet surface and subsequently to cause said pawl to reengage said ratchet sector to raise said nozzle, the abutment contacting face of said cam having a predetermined contour whereby the elevation of said nozzle is governed by the point of contact of said cam and abutment when said nozzle is in contact with the carpet surface.

9. In a suction cleaner having a casing provided with a nozzle and a wheeled support for said casing having pivotal connection therewith and means for adjusting the height of said nozzle above the surface of the carpet to be cleaned, comprising a ratchet sector pivotally mounted on said wheeled support and normally supporting said casing from beneath through the medium of a cam of predetermined contour having bearing contact with an abutment on said casing, an operating lever mounted on said wheeled support, a spring-pressed pawl carried by said operating lever and normally engaging said ratchet sector to hold the latter in stationary position, but shiftable in the movement of said operating lever in one direction to release said ratchet sector and thereby permit said nozzle to drop into contact with the carpet surface and shiftable in another direction in the movement of said operating lever to its initial position to reengage said ratchet

sector and to thereby raise said nozzle a distance governed by the point of contact of said cam with said abutment when said nozzle is in contact with the carpet surface.

10. In a suction cleaner having a casing provided with a nozzle and a wheeled support for said casing including a frame pivotally connected therewith, and means for adjusting said casing relative to said support to vary the height of said nozzle above the surface of the carpet to be cleaned, comprising a ratchet lever pivotally mounted on said supporting frame and provided with a toothed sector and a cam having bearing contact with an abutment on said casing, an operating lever pivotally mounted on said frame and having a pawl adapted normally to engage the toothed sector of said ratchet lever and shiftable bodily to release said sector in the movement of said operating lever in one direction, to thereby affect the lowering of said nozzle into contact with the carpet surface and shiftable into a position to reengage said sector in the movement of said operating lever in the opposite direction and raise said nozzle, said abutment on said casing and said cam having coacting bearing faces of predetermined contour and angularity whereby the elevation of said nozzle varies with the location of a point of contact of said cam with said abutment when said nozzle is in contact with the carpet surface.

11. In a suction cleaner having a casing provided with a nozzle and a wheeled support for said casing including a frame pivotally connected to said casing and having wheels journalled thereon, and means for adjusting said casing relative to said support to vary the height of said nozzle above the surface of the carpet to be cleaned, comprising a ratchet lever pivotally mounted on said supporting frame and provided with a toothed sector and a cam having bearing contact with an abutment on the underside of said casing, an operating lever mounted on said frame, a spring-pressed pawl carried by said operating lever and normally engaging the toothed sector of said ratchet lever to maintain said casing in a predetermined position of adjustment, said operating lever being shiftable in one direction to effect the disengagement of said ratchet sector by said pawl and the lowering of said nozzle into contact with the carpet surface and in the opposite direction to effect the reengagement of said ratchet sector by said pawl, and the raising of said nozzle, said abutment and cam having contacting surfaces of a predetermined contour and angularity whereby the relative position of said casing and wheeled support when said nozzle is in contact with the carpet surface increases the subsequent elevation of said nozzle in direct proportion to the depth of penetration of said wheels into the carpet surface.

12. In a suction cleaner having a casing provided with a nozzle at its forward end and a wheeled carriage pivotally connected to the underside of said casing adjacent one end thereof, an adjustable member on said carriage normally supporting said casing adjacent its opposite end, operating means acting to depress momentarily said casing supporting member to permit said nozzle to drop into contact with the surface of the floor covering, tension means for subsequently elevating said nozzle to a predetermined height above said surface and means for automatically adjusting the elevatiton of said nozzle to compensate for the varying depth of penetration of the supporting wheels into carpets of different texture.

13. In a suction cleaner having a casing provided with a nozzle at its forward end and a carriage pivotally connected to the underside of said casing adjacent its rear end and having supporting wheels adjacent the forward end thereof, an adjustable contact member on said carriage supporting the forward portion of said casing with said nozzle above the surface of the carpet and operator actuated ratchet mechanism operative to depress momentarily said adjustable contact member to lower said nozzle into contact with the carpet and including compensating means whereby the subsequent elevation of said nozzle is automatically determined by the penetration of the supporting wheels into the carpet pile.

14. In a suction cleaner having a casing provided with a nozzle at its forward end and a wheeled carriage pivotally connected with the underside of said casing, said connection being adjacent one end thereof, a ratchet lever carried by said wheeled carriage and having a cam supporting said casing adjacent the opposite end thereof, an operating lever pivotally mounted on said carriage and having a spring pressed pawl normally engaging a toothed sector on said ratchet lever to hold the same against displacement, said operating lever being shiftable in one direction to disengage said pawl from said sector, thereby dropping said nozzle into flush contact with the surface of the floor covering under the weight of said casing, and tension means acting to return said operating lever in the opposite direction whereby said ratchet sector is reengaged by said pawl to elevate said nozzle a predetermined fixed distance above the surface of said floor covering plus an amount equal to the depth of penetration of the wheels into the same.

15. In a suction cleaner having a casing provided with the nozzle at its forward end and a carriage beneath said casing and pivotally connected adjacent the rear end thereof, a ratchet lever pivotally mounted on said carriage and having a cam at one end supporting said casing and a toothed sector at its opposite end, an operating lever pivotally mounted on said carriage, a spring pressed pawl lever pivotally mounted on said operating lever and normally having toothed engagement with the sector of said ratchet lever, tension means acting on said operating lever to hold the same in its normal position wherein the nozzle portion of said casing is supported above the carpet surface, said pawl member acting during the movement of said operating lever in one direction to effect the release of said sector whereupon said nozzle is permitted to drop into contact with the carpet surface and upon the subsequent release of said operating lever and its return to its normal position under the tension of said spring to reengage said sector and thereby actuate said cam to raise said nozzle a predetermined distance above the surface of said floor covering, said cam and casing having contact faces of a predetermined contour whereby the elevation of the nozzle above the surface of the carpet is automatically adjusted to compensate for the depth of wheel penetration into said carpet.

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