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Clowers et al.

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[45] **Jan. 30, 1973**

[54] VACUUM CLEANER WITH NOZZLE HEIGHT ADJUSTING MECHANISM

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[52] **U.S. Cl.**.....**15/354,** 15/361

[51] **Int. Cl.**.....**A47l 5/34**

[58] **Field of Search**.....15/354, 358, 361, 355, 356, 15/357

[56] **References Cited**

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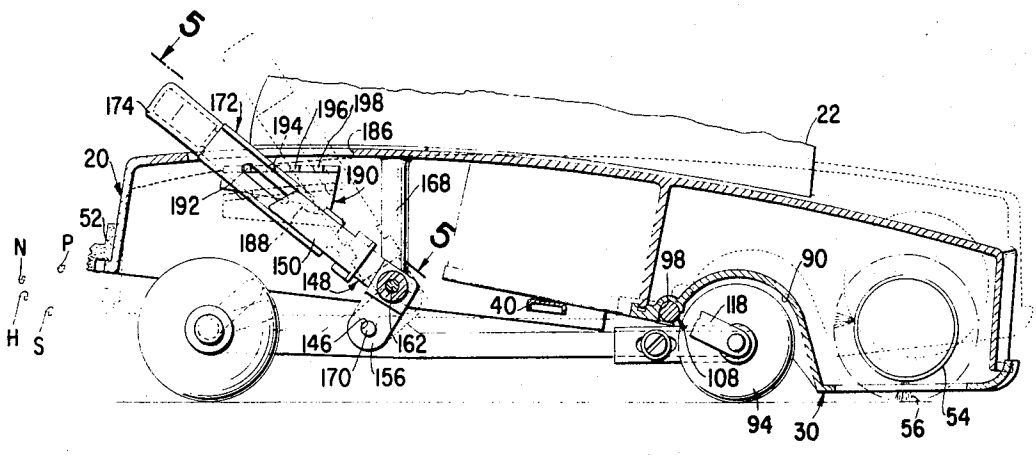
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[57] **ABSTRACT**

An upright vacuum cleaner having a suction nozzle at the front of an access plate mounted on the bottom of the chassis. At least four nozzle height positions relative to the surface of the floor to be cleaned is obtained by manually indexing an adjusting lever pivotably mounted on one side of the cleaner and having a pin mounted in one leg thereof. The rear wheels of the cleaner are rotatably mounted on the ends of a crank type offset axle pivotably mounted on the bottom of the cleaner frame. Two front wheels of the cleaner are each mounted on one leg of separate U-shaped axles, each having its other leg pivotally supported on opposite sides of the bottom of the frame. Linage assemblies connect each end of the rear axle to the respect wheel mounted leg of each front wheel axle. The linkage on the adjustable lever side of the cleaner includes a slot for receipt of the lever pin so that as the lever is pivotably moved the pin drives the linkage, thus causing the front and rear axles simultaneously to pivot on their respect journals. This effects a change in the relation between all four wheels and the cleaner housing, thereby raising or lowering the nozzle relative to the floor.

7 Claims, 5 Drawing Figures



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SHEET 1 OF 2

Fig. 2

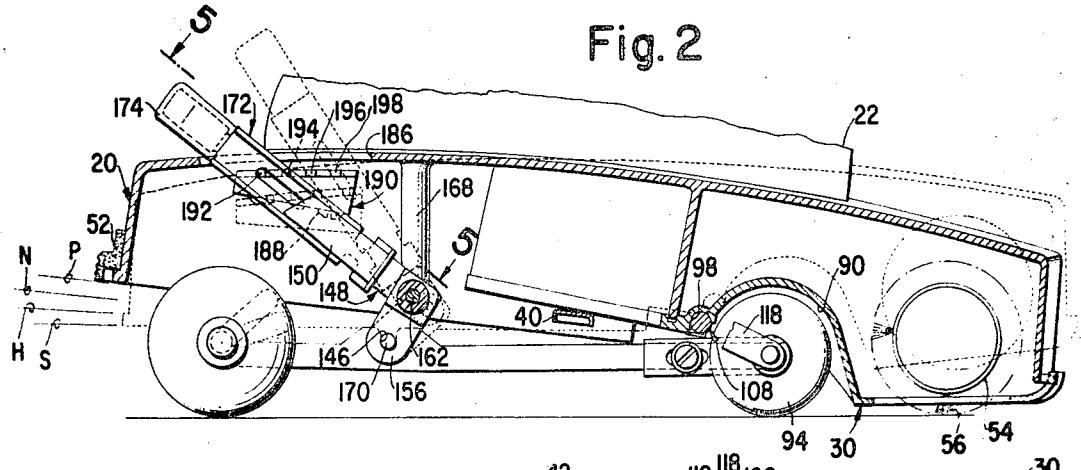
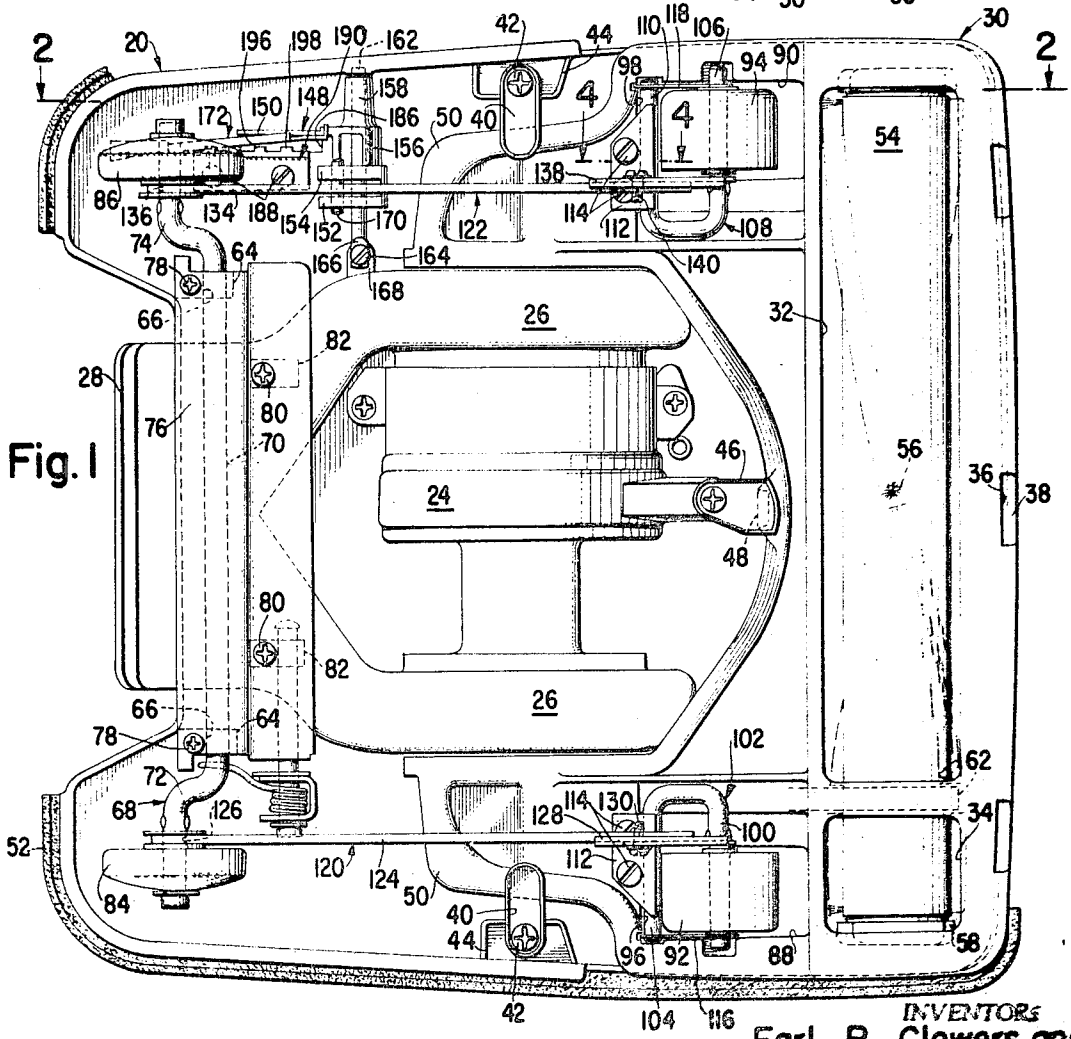


Fig. 1



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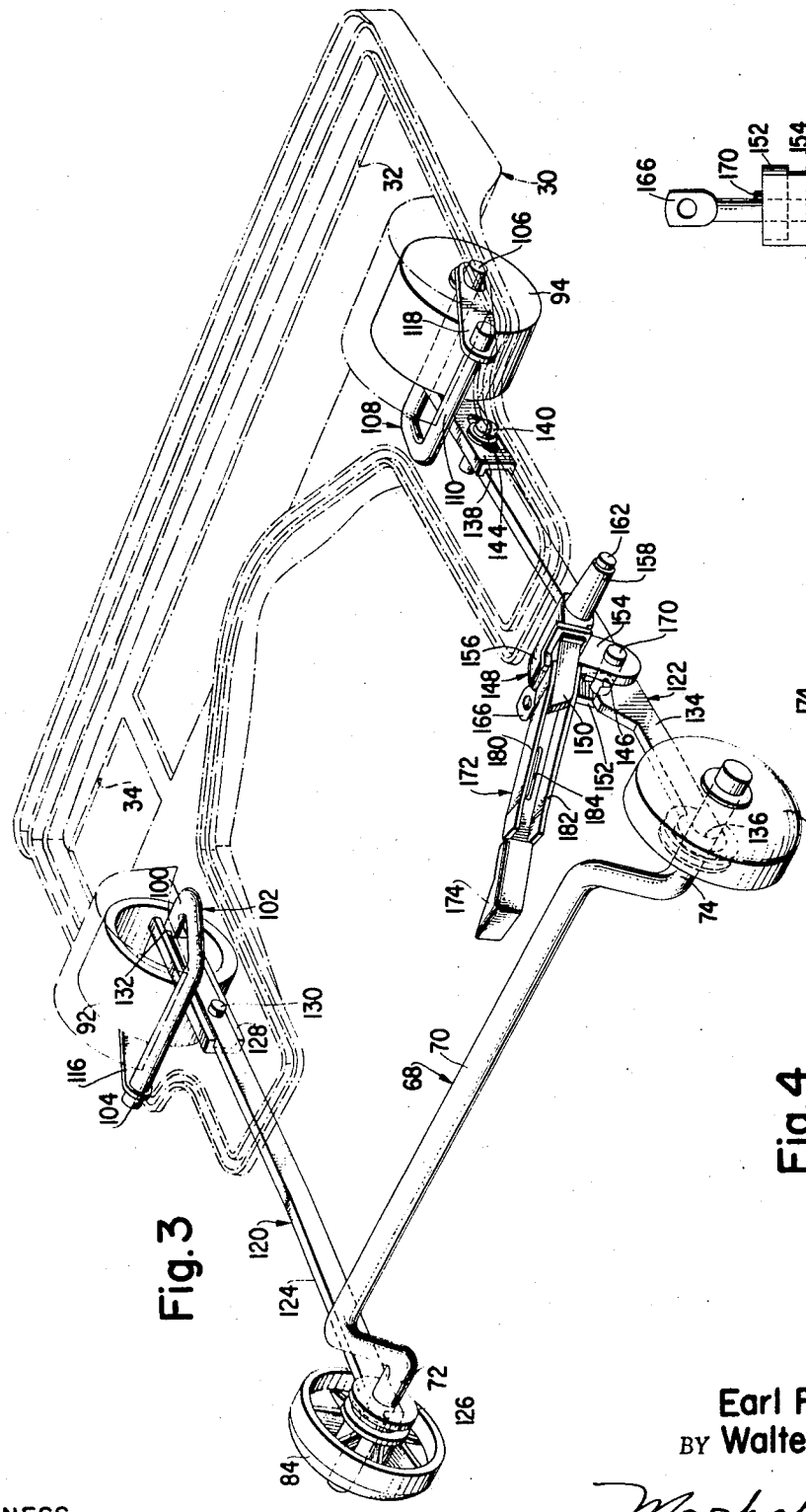


Fig. 3

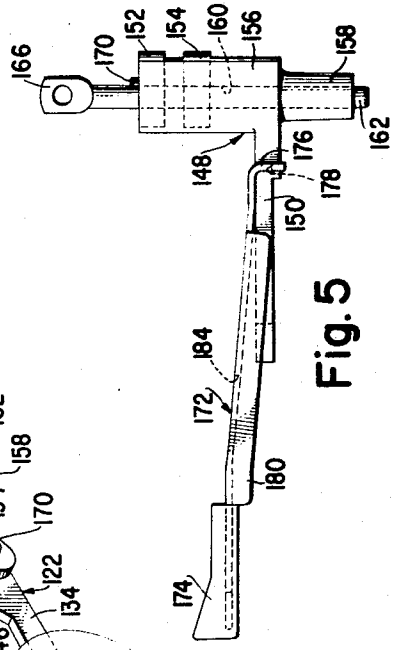


Fig. 5

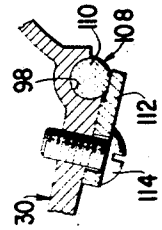


Fig. 4

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VACUUM CLEANER WITH NOZZLE HEIGHT ADJUSTING MECHANISM

BACKGROUND OF THE INVENTION

This invention relates to vacuum cleaners and more particularly to a vacuum cleaner of the floor cleaning type having means for raising and lowering the nozzle depending on the type of floor covering being cleaned.

Vacuum cleaners of the floor cleaning or upright type generally include a chassis having a nozzle at the bottom thereof through which air is suck by an air moving motor-blower unit, a rotary brush mounted adjacent to the nozzle for contacting the floor surface to agitate and loosen the dirt so that it may be sucked free of the surface, and wheels mounted at the front and rear of the chassis for supporting the cleaner for rolling on the floor. These vacuum cleaners are called upon to clean many different kinds of modern floor coverings varying in pile thickness from the short thin outdoor or patio type to the long deep shag type. In order to clean these various floor surfaces effectively it is known to vary the nozzle height to locate the nozzle at a level above the surface that provides the proper suction and flow path for the particular type floor covering or surface being cleaned.

Nozzle height adjusting mechanism are known which raise or lower the nozzle by raising or lowering either the front or the rear wheels relative to the chassis, thereby to tilt the chassis about the non-adjustable wheels. However, the variation in pile thickness of modern floor coverings is so extreme that if only one set of wheels are adjusted the chassis must tilt through a wide angle between the extremes of the desired nozzle height. Inasmuch as large variations in the chassis angle relative to the floor have adverse affects on the suction capability of the nozzle and the beater action of the brush, poor cleaning results occur at these extreme conditions. For example, in those cleaners designed with adjustable rear wheels only the chassis pivots about the front wheels and the rear of the chassis undergo wide variations in elevation. When such a cleaner is operated on low pile carpeting, especially outdoor type carpeting and bare floors, the rear of the chassis rises, and because of the steep angle the brush may throw the loosened dirt back too low for the nozzle effectively to suck it in. Furthermore, when such a cleaner operates on high pile carpeting the rear of the chassis may drop too low and drag on the floor surface thus causing extra wear on the carpeting. In those cleaners having adjustable front wheels only, the front end of the chassis may tend to dig into the carpeting on low pile carpeting while the rear end may dig in on high pile carpeting. Moreover, in both types of arrangements, the silhouette of the chassis when the front end is raised for cleaning high pile carpeting is such that it may not get under furniture for proper cleaning.

SUMMARY OF THE INVENTION

The primary object of the present invention is to provide an improved nozzle height adjusting mechanism for a vacuum cleaner of the above type, whereby the nozzle height may be varied between wide limits while maintaining a greatly reduced angular variation of the chassis relative to the floor.

Another object of the invention is to provide an on-the-floor vacuum cleaner having an improved nozzle height adjusting mechanism which raises and lowers the nozzle by varying the relationship of the chassis to the front and the rear wheels.

A further object of the invention is to provide an improved nozzle height adjusting mechanism in a vacuum cleaner of the type which is supported on front and rear wheels, whereby the axes of rotation of all the wheels may be selectively varied relative to the nozzle.

A still further object of the invention is to provide an improved nozzle height adjusting mechanism in a vacuum cleaner of the type which is supported on front and rear wheels, whereby the front and rear wheels simultaneously are pivoted by a single control member relative to the nozzle, the front wheels rising while the rear wheels lower and the front wheels lowering while the rear wheels rise.

Accordingly, this invention provides a vacuum cleaner comprising a chassis having a suction nozzle therein arranged for floor cleaning, a pair of front wheels and a pair of rear wheels which support the cleaner for rolling on the floor. The rear wheels are mounted on offset ends of a rear axle formed with the central portion which is journaled in the rear of the chassis. The front wheels are each mounted on one leg of separate U-shaped axles, each having its other leg pivotally supported on opposite sides of the bottom of the frame. Linkage assemblies connect each offset end of the rear axle to the wheel mounted leg of a respective front wheel axle. An adjustable lever is pivotably mounted on one side of the chassis and operatively engages the linkage on said side so that as the lever is pivotably moved the linkage is driven to cause the front and rear wheels simultaneously to pivot in the respective journals, the front wheels rising when the rear wheels lower and the front wheels lowering when the rear wheels rise relative to the chassis. This affects a change in the relation between all four wheels and the chassis, thereby raising or lowering the nozzle relative to the floor while maintaining a small angular variation in the attitude of the chassis.

BRIEF DESCRIPTION OF THE DRAWINGS

The particular features and advantages of the invention as well as other objects will become apparent from the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a bottom plan view of a vacuum cleaner embodying the present invention;

FIG. 2 is a cross sectional view taken substantially along line 2—2 of FIG. 1, illustrating the lowest nozzle height position in solid lines and the highest nozzle height position in dotted;

FIG. 3 is a perspective view of the nozzle height adjusting mechanism removed from the cleaner chassis to show details of construction, and showing the chassis access plate including the nozzle opening in phantom;

FIG. 4 is a cross sectional view taken substantially along line 4—4 of FIG. 1; and

FIG. 5 is a cross sectional view taken substantially along line 5—5 of FIG. 2, illustrating the adjustment lever assembly.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring now to the accompanying drawings, wherein like reference numerals denote similar parts

throughout the various views, there is disclosed the working portion of a vacuum cleaner of the type known as a floor cleaner, or upright vacuum cleaner. A cleaner of this type is shown in its entirety in U.S. Pat. No. 3,163,439 which issued on Dec. 29, 1964 to the same assignee as the present invention, and since the propelling handle and dust bag are conventional and form no part of the present invention and are not necessary for a clear understanding thereof, reference should be had to said patent for a disclosure of the complete cleaner.

The vacuum cleaner includes a chassis **20**, on the top of which is secured a hood **22**. Formed in the bottom of the chassis is a central recess **24** within which is housed an electric motor (not shown), and a pair of recesses **26, 26** for housing a pair of fan impellers (not shown). The motor drives the fan impellers which communicate with a rearwardly open common discharge duct **28** to which is secured a dust bag assembly, as illustrated in the aforesaid U.S. Pat. No. 3,163,439. An access plate **30** having a pair of apertures **32** and **34** disposed therein is releasably secured to the bottom of the chassis. The access plate **30** includes in the front edge thereof three slots **36** which are adapted to register with respective tabs **38** formed on the bottom leading edge of the chassis. A pair of retaining clips **40**, movably secured by screws **42** to shoulders **44** on opposite sides of the bottom of the chassis, and a latch **46** on the chassis which cooperates with a lug **48** on the access plate, operate to secure the access plate to the chassis when the tabs **38** are in proper registration with the slots **36**. The vacuum cleaner inlet nozzle, which is defined by the apertures **32** and **34**, communicates with the fans by means of air passages defined between the bottom of the chassis and a pair of rearwardly extending arms **50** of the access plate to produce a suction at the nozzle inlet when the motor is in operation. A conventional rubber bumper **52** aids in sealing the access plate and chassis to minimize the suction losses between the fan and the nozzle inlet. The fan exhaust air is discharged through the duct **28** and into the dust bag in the conventional manner. A rotary floor brush assembly **54** including a spirally disposed brush **56** is mounted in the nozzle above the openings **32** and **34** and includes a pair of bearings **58** at its extremities positioned in corresponding mounting plates **60** at opposite sides of the chassis so as to contact the floor surface when the cleaner is in the operating position as shown in FIG. **2**. An endless belt **62** drives the brush assembly from a spindle (not shown) on the motor fan shaft.

A pair of downwardly depending bosses **64**, each having a bearing recess **66** formed therein, are cast on opposite sides of the rear of the chassis. A rear axle **68**, including a central portion **70** having offset end portions **72** and **74**, is journaled on the central portion in the bearing recesses **66** and pivotably maintained therein by a retaining plate **76** which is secured to the chassis by screws **78** threaded into the bosses **64** and screws **80** which are threaded into a pair of bosses **82** cast on the bottom of the chassis. Rotatably mounted on the free extremity of each offset end **72** and **74** is a respective rear wheel **84** and **86**. As in the aforesaid U. S. Patent, turning of the rear axle about the central portion **70** results in a raising or lowering of the rear wheels **84** and **86** relative to the chassis. In other words, a lowering or raising of the chassis and nozzle relative to the rear wheels occurs when the rear axle **68** is turned in the bearings **66**.

Formed in opposite sides of the access plate **30**, just behind the nozzle openings **32** and **34**, is a pair of front wheel recesses **88** and **90** within which respective front wheels **92** and **94** are positioned. A second and smaller pair of recesses **96** and **98** is formed in the access plate adjacent to, but behind, a respective one of the wheel recesses **88** and **90**. The wheel **92** is rotatably mounted on one leg **100** of a U-shaped axle **102** having its second leg **104** positioned within the recess **96**, and the wheel **94** is rotatably mounted on a leg **106** of a similar U-shaped axle **108** whose other leg **110** is positioned within the recess **98**. At each side of the access plate, adjacent a respective recess **96** and **98**, there is mounted a retaining plate **112** which is secured to the access plate by screws **114**, thereby entrapping legs **104** and **110** within the respective recess **96** and **98**, while allowing the legs **104** and **110** to be journaled for pivotable movement. Thus, the front wheels **92** and **94**, and their respective axes of rotation **100** and **106**, may be raised or lowered relative to the chassis and the nozzle by pivoting about the respective journaled leg **104** and **110**. Conversely, the nozzle may be lowered or raised by movement of the wheels **92** and **94** about legs **104** and **110**, or movement of the chassis about legs **100** and **106**. Retaining links **116** and **118** respectively secure wheels **92** and **94** against axial movement.

The front and rear wheel assemblies are interconnected at respective sides of the cleaner by linkage assemblies **120** and **122**. Linkage assembly **120** includes a first link arm **124** having a hole **126** at one end thereof through which passes the offset end **72** of the rear wheel axle **68**, and a second link arm **128** secured to the arm **124** by a screw **130** adjacent one end thereof and includes a hole **132** at the other end thereof through which front axle leg **100** passes. Similarly, the linkage assembly **122** includes a link arm **134** having a hole **136** on the rear end thereof through which passes the offset portion **74** of the rear axle **68** while the other end of the link arm **134** is secured to one end of a second link arm **138** by means of a screw **140** and a hole not shown at the other end of link arm **138** receives the leg **106** of the axle **108** therethrough. A slot **144** in the link arm **138** is provided so that the relationship between the arms **134** and **138** may be adjusted at the factory to provide the proper movement of the wheel **94** and the wheel **86**. The link arm **128** includes a similar slot (not shown) for the same purpose. Formed in the link arm **134** is a notch **146**, the purpose of which will be hereinafter explained. It should, however, be apparent that the axes of rotation of all four wheels are simultaneously moved relative to the chassis and nozzle by the operation of the linkages **120** and **122**. The combined length of the link arms **134** and **138**, and of the arms **124** and **128** are longer than the distance between the central portion **70** of the rear axle **68** and the legs **104** and **110** of the front axles **102** and **108**; i.e., the lateral distance between the front and rear journals is less than the lateral distance between the axes of rotation of the front and rear wheels, and the front wheels pivot relative to the chassis about an axis **104** and **110** which is behind the axes of rotation **100**

and 106 and the rear wheels pivot relative to the chassis about an axis 70 which is in front of the axes of rotation 72 and 74, so that any movement of the front wheels in an upwardly direction relative to the chassis and nozzle results in the rear wheels lowering relative thereto, and any lowering of the front wheels relative to the chassis and nozzle results in the rear wheels raising. The same result could occur if the lateral distance between the front and rear journals is greater than the lateral distance between the axes of rotation of the front and rear wheels if the front journals are in front of the front wheel axes and the rear journals are behind the rear wheel axes. In both cases the greater the difference between the axle journal distance and the wheel axis distance, the smaller the movement required for a given nozzle height variation.

In order to manually adjust the wheel assemblies there is provided an adjustment lever 148 comprising an arm 150 having a pair of bifurcated legs 152 and 154 integral with and spaced from the arm 150 by a transverse portion 156. The lever 148 further includes an integral bushing portion 158 extending from the transverse portion 156 at the side adjacent the arm 150. Extending through the transverse portion 156 and the bushing 158 is an aperture 160 through which a pin or axle 162 passes. The axle 162 is secured at one end in a hole in the chassis and is secured by a screw 164 in a flattened portion 166 at the other end thereof to a boss 168 on the bottom of the chassis. Another pin 170 passes through and extends between holes formed in the bifurcated legs 152 and 154 and is adapted to engage and fit within the notch 146 in the link 134. A lock spring 172 having a manually engageable handle portion 174 secured at one extremity thereof and a bent portion 176 having an aperture 178 at the other extremity thereof is positioned on the arm 150 by passing the arm through the aperture 178. The lock spring 172 includes two flanges 180 and 182 between which the arm 150 is positioned after passing through aperture 178, and also includes a slot 184, the purpose of which will presently be described. The arm 150 includes a groove adapted to receive the outer extremity of the aperture 178 of the bent portion 176 and acts as fulcrum for the spring. The upper portion of the chassis above the spring member includes an opening 186 through which the handle 174 and a portion of the spring flanges extend. Secured to a boss at the underside of the chassis by means of screws 188 is a step bracket 190 having a plurality of, preferably four, teeth 192, 194, 196, 198 extending horizontally from the upper portion thereof. The spring 172, as shown in FIG. 5, is bent away from arm 150 of lever 148 so that when it is positioned on the arm 150 it is biased such that the slot 184 is forced against the tooth portion of the bracket member 190. A manual force is, therefore, required to overcome the bias to disengage the spring from the teeth. Thus, the spring may be manually moved by means of the handle 174 to selectively engage the slot 184 with a desired one of the teeth 192, 194, 196, 198. Movement of the handle 174 in the plane of the paper as shown in FIG. 2 causes the adjustable lever 148 to turn about the shaft 162 thereby forcing the pin 170 to coact with the notch 146. This effects movement of the links 134 and 138 which causes all four wheels to pivot about their respective chassis mounting journals and thereby raises or lowers the chassis and the nozzle relative to the wheels and the floor surface upon which the wheels set.

In FIG. 2 the vacuum cleaner is illustrated in solid lines in the lowerest nozzle height position and the rear of the chassis is thus in its highest position. Inasmuch as this position is optimum for cleaning outdoor type carpeting, i.e., patio carpeting, the extension of the line of the bottom of the chassis is designated "P." In order to raise the nozzle, the handle 174 is pushed outward away from tooth 192 and then moved clockwise toward one of the other teeth and is then released so that the slot 184 locks with the selected tooth. Each other tooth 194, 196, 198 corresponds with a fixed nozzle height position designated normal, high or shag for the various types of floor coverings. FIG. 2 illustrates in dotted lines the highest nozzle height corresponding to shag carpeting. The extension of the line of the bottom of the chassis at each of these detent positions is shown and designated "N" for normal carpeting, "H" for high pile carpeting, and "S" for the shag type carpeting. Of course, other nozzle heights are available by deploying more teeth on the bracket 190. However, it should be understood that by pivoting the chassis about both the front and rear wheels to effect a nozzle height change, a reduced angular variation of the chassis relative to the floor results as compared to merely pivoting the chassis about either the front or rear wheels separately.

Numerous alterations of the structure herein disclosed will suggest themselves to those skilled in the art. However, it is to be understood that the present disclosure relates to a preferred embodiment of our invention which is for purposes of illustration only and not to be construed as a limitation of the invention. All such modifications which do not depart from the spirit of the invention are intended to be included within the scope of the appended claims.

Having thus set forth the nature of the invention, what is claimed herein is:

1. A nozzle height adjusting mechanism for a vacuum cleaner having a chassis including a suction nozzle inlet at the bottom thereof, said mechanism comprising in combination front and rear wheels for supporting said chassis for movement on a floor surface, front axle means having offset portions on which said front wheels are journaled and rear axle means having offset portions on which said rear wheels are journaled, said front axle means including journal portions turnably mounted on said chassis providing for movement of said front wheels toward and away from said chassis upon turning of said journal portions, said rear axle means including journal portions turnably mounted on said chassis providing for movement of said rear wheels toward and away from said chassis upon turning of said journal portions, linkage means interconnecting said offset portions of said front and rear axle means for simultaneous movement of said front wheels and said rear wheels indifferent vertical directions relative to said chassis, and adjustment means movable between a plurality of positions for selectively moving said linkage means to vertically move said front and rear wheels in different directions relative to the chassis, whereby said nozzle is vertically moved relative to the floor.

2. A nozzle height adjusting mechanism as recited in claim 1 wherein the distance between the offset portion

of the front and rear axle means differs from the distance between the journal portions thereof.

3. A nozzle height adjusting mechanism as recited in claim 2 wherein said rear axle means comprises a rear axle extending from side to side of said chassis including a central portion, offset arms formed on opposite ends of said central portion, a rear wheel rotatably carried on each offset arm, said central portion having journal portions, spaced bearings on the rear of said chassis pivotably mounting said journal portions, said front axle means comprising a substantially U-shaped shaft at each side of said chassis, each shaft having one leg pivotably mounted on said chassis substantially parallel to the central portion of said rear axle, a front wheel rotatably carried on the other leg of each shaft, said linkage means comprising a linkage assembly at each side of said chassis, each linkage assembly operatively connecting an offset arm portion of said rear axle with a respective front wheel carrying leg.

4. A nozzle height adjusting mechanism as recited in claim 3 wherein said means for selectively moving said linkage means comprises a lever member, means pivotably mounting said member on said chassis, said member including a pin, the linkage assembly on at least one side of the chassis having a notch formed therein for receiving said protrusion, and means for selectively pivoting said lever to move said linkage assembly and thereby all said wheels.

5. A nozzle height adjusting mechanism as recited in claim 4 wherein said means for selectively pivoting said lever comprises a spring member having one end thereof fastened to said lever and a manually engageable handle mounted on its other end for moving said spring in a direction to pivot said lever, and means for locking said spring to said chassis, said spring being normally biased in the locking direction so that the bias must be manually overridden to move said spring in the pivoting direction.

6. A nozzle height adjusting mechanism as recited in claim 3 wherein the lateral spacing between the central portion of said rear axle and the pivotably mounted leg of each respective U-shaped shaft is smaller than the lateral spacing between each offset arm of the rear axle and the front wheel carrying leg of each respective U-shaped shaft.

7. A nozzle height adjusting mechanism as recited in claim 6 wherein said means for selectively moving said linkage means comprises a lever member, an axle mounted on one side of said chassis, said lever member being journaled on said axle for pivotal movement relative to said chassis and having a pin spaced from and substantially parallel to said axle, the linkage assembly on said one side of the chassis including a notch for receiving said pin, a leaf spring fastened at one end to said lever and having a handle secured to its other end and extending through the chassis, detent means for locking said spring and lever against movement, said spring having a bend formed therein so that the spring is normally biased into locking relation with said means for locking and may be released therefrom by overriding said bias, whereby arcuate movement of said handle effects pivotal movement of said spring and lever about said axle and the linkage assembly on said one side of the chassis is moved by coaction of the pin and notch.

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