Oct. 19, 1954 W. A. HUMPHREY 2,691,792

SUCTION CLEANER HAVING INTERLOCKED NOZZLE ADJUSTING AND CONVERTING MECHANISM

Filed July 13, 1950 3 Sheets-Sheet 1

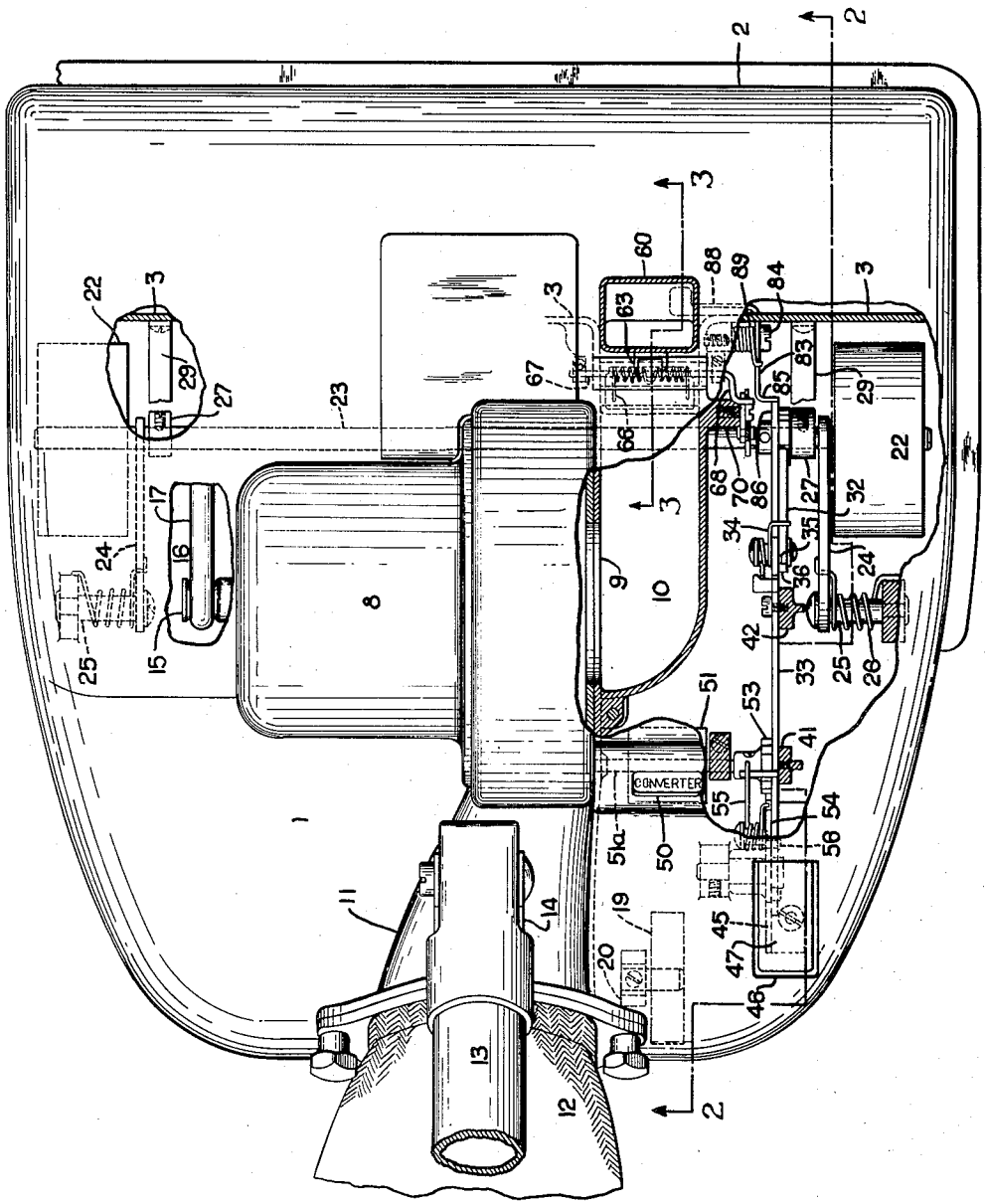



Fig. 1

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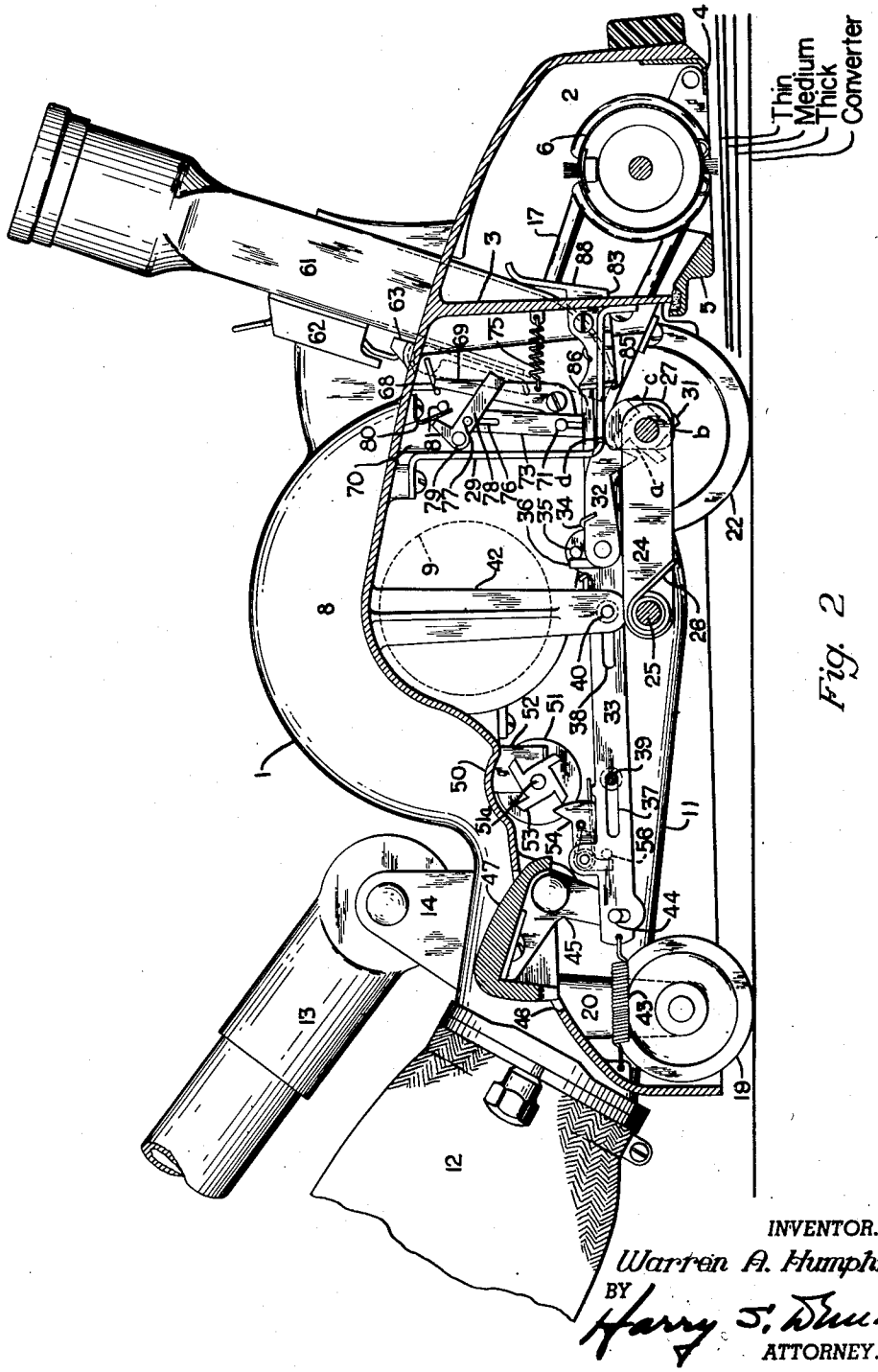



Fig. 2

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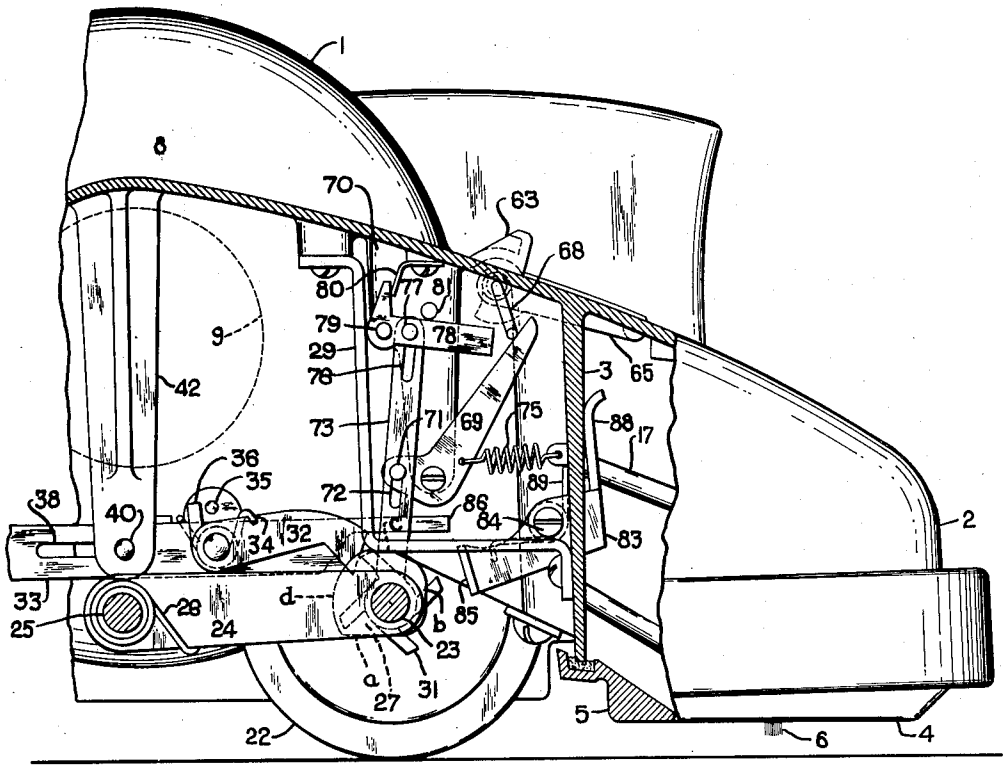



Fig. 4

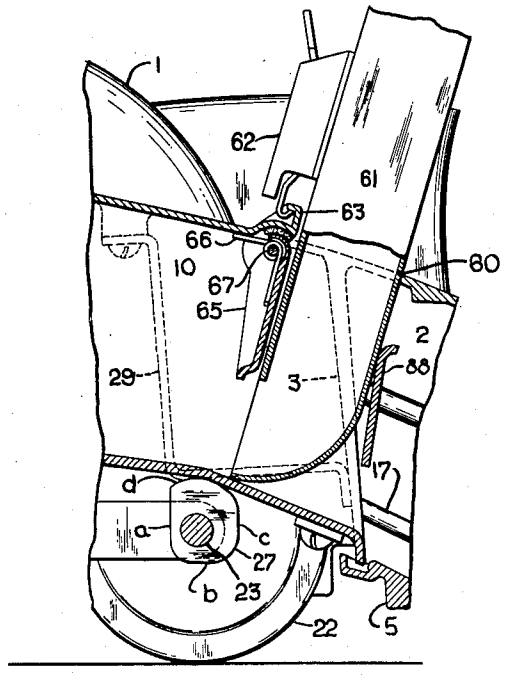



Fig. 3

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Patented Oct. 19, 1954

2,691,792

# UNITED STATES PATENT OFFICE

2,691,792

## SUCTION CLEANER HAVING INTERLOCKED NOZZLE ADJUSTING AND CONVERTING MECHANISM

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Application July 13, 1950, Serial No. 173,619

7 Claims. (Cl. 15—333)

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The present invention relates to the art of cleaning devices and more particularly to a novel mechanism for controlling the position of a suction cleaning nozzle and agitating member with respect to the surface being cleaned and for conditioning the apparatus for conversion to off-the-floor cleaning operations.

It is a principal object of the present invention to provide a suction cleaning apparatus including a mechanism which adjustably alters the relative position of the cleaning nozzle with respect to a supporting surface to adjust the same for cleaning surface coverings having different characteristics and which also conditions the apparatus for the attachment thereto of a converting tool for off-the-floor cleaning operations.

It is a further object of the present invention to provide a suction cleaning apparatus having a mechanism which maintains the converter passage closure in a locked position until the cleaning nozzle and agitator are moved to a non-cleaning position so as to prevent undue wear or surface cover damage while the apparatus is converted for off-the-floor cleaning operations.

According to the present invention, I have provided a suction cleaning apparatus, including a foot pedal at the rear of the cleaner proper which operates through a suitable mechanism to change the position of the front supporting wheels of the cleaner relative to the body thereof to change the position of the suction cleaning nozzle with respect to a supporting surface, and, in one position, to unlatch and open a barrier valve providing for admission of a converting tool.

Other objects and advantages of the invention will become apparent as the description proceeds when taken in connection with the accompanying drawings in which Figure 1 is a top plan view partly in section illustrating a suction cleaning apparatus embodying my invention. Figure 2 is a sectional view taken substantially along the lines 2—2 of Figure 1 and looking in the direction of the arrows. Figure 3 is a sectional view taken along the lines 3—3 of Figure 1 and looking in the direction of the arrows. Figure 4 is a sectional elevational view of the apparatus of Figures 1 and 2 illustrating the same in normal cleaning condition with the converter barrier valve closed and locked.

Referring now to the drawings in detail, and first to Figure 1 thereof, the present invention is illustrated as being applied to a suction cleaning apparatus of the type having an elongated nozzle extending across the front thereof and communicating with the air inlet of a motor fan unit having its axis horizontal and parallel to

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the nozzle structure. The agitator is driven by a belt actuated by the motor and running through a separate belt tunnel on the side of motor fan unit opposite to the fan. This general type of cleaner arrangement is illustrated in the U. S. Patent to Becker, 2,366,479. The cleaner comprises a main frame or body casing 1 having an elongated suction air nozzle 2 extending across the front thereof and defined by the top and front walls of the casing 1 and a depending partition wall 3 forming the rear wall of the suction air nozzle passageway. The nozzle lips may be of any desired type but are here shown as being formed by removable plates 4 and 5 attached respectively to the front wall of the casing 1 and the partition 3. A rotary brushing and agitating element 6 of a known type is rotatably mounted in the casing 1 so as to have the brushing and agitating elements positioned substantially in the central portion of the nozzle defined by the plates 4 and 5 and projecting slightly therebelow so as to engage and clean a surface covering lying beneath the nozzle lips. A combined motor and suction air fan unit 8 is mounted in the casing 1 rearwardly of the nozzle with the motor fan axis parallel to the nozzle. The fan of this unit has an air inlet opening 9 which communicates with an air tunnel 10 formed in the frame 1 and opening to the nozzle 2 through an interrupted portion of the partition 3, as shown most clearly in Figure 1. The fan of the motor fan unit 8 discharges dirt laden air through a passageway 11 on the rear end of which is mounted a conventional air filter 12. A manipulating handle 13 is pivotally attached to brackets or ears 14 carried by the main frame 1. The ends of the motor fan unit opposite to that communicating with the air tunnel 10 is provided with a projecting pulley 15 which projects into a suitably formed tunnel or passageway 16 in the frame 1 to provide for a belt 17 which embraces the rotary agitator 6 and the pulley 15 to provide for positive drive of the rotary brushing and agitating element.

The rear portion of the cleaner is carried by a pair of supporting wheels 19, only one of which is shown, rotatably mounted upon supporting bosses 20 depending from the underside of the frame 1 on opposite sides of the exhaust duct 11.

The front portion of the cleaner is carried by a pair of wide tread supporting wheels 22 which are rotatably mounted on the opposite ends of a shaft 23 extending transversally of the cleaner under the tunnels 10 and 16 and just rearwardly of the nozzle. The shaft 23 is rotatably mounted in arms 24 pivoted on inwardly projecting studs

25 attached to the side walls of the casing 1 rearwardly of the shaft 23. Torsion springs 26 are mounted on studs 25 and arranged to bias the supporting wheels 22 upwardly toward the frame 1. A pair of adjusting cams 27 are non-rotatably mounted upon the shaft 23 adjacent each of the arms 24 as shown most clearly in Figure 1. The cams 27 are identical and are secured to the shaft 23 in alignment. Each cam is provided with four adjusting surfaces indicated in Figure 2 as *a*, *b*, *c*, and *d*, respectively. Each cam 27 bears upon a right angularly bent supporting bracket 29 having one leg secured to the under surface of the top wall of the casing 1 and a forwardly projecting horizontal leg secured to the rear face of the partition 3. As illustrated in Figure 2, the cam surface "*d*" is bearing on the horizontal leg of the bracket 29. This surface is the maximum distance from the shaft 23, hence the cleaner casing is raised with respect to the wheels and the nozzle and agitating and brushing structure is raised above surface cleaning position. This is the converting condition of the apparatus. When the cam is rotated to engage the surface "*a*" with the bracket 29, the nozzle is lowered to its lowermost position which is that provided for very thin floor coverings. The surfaces "*b*" and "*c*" progressively raise the nozzle above the position occupied when surface "*a*" engages bracket 29 to condition the nozzle for cleaning medium and thick surface coverings respectively.

The wheel shaft 23 is rotated to shift the cams 27 for the purpose of adjusting the nozzle height by a mechanism now to be described. A four-toothed ratchet wheel 31 is rigidly attached to the shaft 23 in position to be engaged by a pawl 32 pivotally supported by a slide bar 33. The pawl is biased downwardly, as viewed in Figure 2, by a torsion spring 34 to the limit allowed by a stop pin 35 adapted to be engaged by a stop arm 36 on the pawl. The pawl is so shaped that it will rotate the ratchet wheel 31 in a clockwise direction, as viewed in Figure 2, when the slide bar 33 is advanced toward the nozzle, and will ride over the ratchet when the slide bar retracts toward the rear of the frame 1. The slide bar 33 is provided with a pair of elongated slots 37 and 38 which receive supporting pins 39 and 40 respectively. The pins 39 and 40 are supported by bosses 41 and 42, respectively, depending from the upper surface of the main frame 1 and are positioned to constrain the slide bar 33 to reciprocatory movement fore and aft of the cleaner body. A tension spring 43 is mounted between the rear of the frame 1 and the rear end of the bar 33 to bias the same to the rear to the limit allowed by the slots 37 and 38.

The slide bar 33 is provided with a slot 44 adjacent its rear end which is engaged by a pin carried on one end of a bell crank lever 45 pivotally supported by suitable supporting ears on the underside of the casing 1. One arm of the bell crank lever projects upwardly through an opening 46 in the casing 1 and is covered with resilient, anti-friction material such as rubber 47 to provide a foot treadle or pedal.

The upper surface of the casing 1, just rearwardly of the tunnel 10, is provided with a raised and slotted portion 50 which overlies an indicating wheel 51 which is carried by a shaft 51*a* pivotally mounted in supporting lugs 52 depending from the upper surface of the casing 1. A four-toothed ratchet wheel 53, which is substantially identical with the wheel 31, is secured on shaft 51*a* to operate the indicating wheel 51.



The ratchet 53 is adapted to be engaged by a pawl 54 mounted pivotally upon the slide bar 33 and biased for counter-clockwise rotation, as viewed in Figure 2, by means of a spring 55. A stop arm and pin 56 are provided to limit counter-clockwise rotation of the pawl 54 under the bias of the spring 55. When the slide bar advances toward the nozzle 2, the pawl engages one of the teeth on the ratchet 53 and rotates the indexing drum counter-clockwise to align a new set of indicia with the slot in the rounded portion 50 of the casing 1. When the slide bar 33 moves to the rear of the casing 1 under the bias of the spring 43, the pawl 54 rides across the teeth on the ratchet wheel 53 without rotating the same. The pawl 54 and ratchet 53 are so aligned that suitable indicia upon the wheel 51, such as "converter," "medium," "thick" and "thin," are brought into registry with the slot in casing 1 when the corresponding surfaces on the cams 27 are brought into engagement with the support bracket 29. The condition of the nozzle structure is always apparent to the operator by a glance at the slotted portion 50 in the casing 1. The mechanism is operated by suitable foot pressure applied to the pedal 47, each stroke advancing the ratchets 31 and 53 one tooth to change the position of the nozzle and to indicate the new position correspondingly. Progressive depression of the pedal 47 progressively indexes the cams 27 to vary the relative position of the nozzle with respect to the supporting surfaces. After each depression of the pedal 47, the tension spring 43 returns the apparatus to the condition illustrated in Figure 2 for a subsequent actuation of the pedal, if that is desired, for further adjustment of the nozzle.

The upper wall of that portion of the casing 1 defining the top wall of the air tunnel 10 is provided with an opening 60 to provide for the insertion of a tool 61 to block off the tunnel 10 from the nozzle 2 and convert the apparatus for off-the-floor cleaning operation. The converting tool 61 is provided with spring catch 62 adapted to engage under a catch plate 63 mounted upon the casing 1 to secure the tool 61 in converting position. The opening 60 is normally closed by suitable valve and barrier element 65 attached to a pintle 67 pivotally mounted on the underside of the top wall of the tunnel 10 and biased to closed position by torsion spring 66. When the tool 61 is inserted, as illustrated in Figure 3, the suction nozzle 2 is inoperative because its communication with the suction fan through the tunnel 10 is interrupted and cleaning air flows to the tunnel 10 through the tool 61 which is attached to a suitable flexible hose carrying a cleaning tool. The pintle 67 has a crank portion 68 extending through the wall of the tunnel 10 into the space between the tunnel 10 and the side wall of the cleaner body. The crank 68 is adapted to be actuated by one arm of a bell crank lever 69 pivotally supported upon a boss 70 on the outer wall of the tunnel 10. The other leg of the bell crank lever 69 carries a pin 71 engaging in a slot 72 in an actuating link 73 pivotally mounted upon the shaft 23. The bell crank lever 69 is biased in a clockwise direction, as viewed in Figures 2 and 4, by means of a tension spring 75 attached to the bell crank and to the partition 3. The link 73 extends above its connection with the bell crank 69 to include an extended portion having a slot 76 engaged by a pin 77 on one arm of a second bell crank lever 78 pivotally mounted on a stud 79 also carried

by the boss 70. The other arm of the bell crank lever 78 is engaged by leaf spring 80 supported upon the underside of the casing 1 and arranged to bias the bell crank in a counter-clockwise direction, as viewed in Figure 4, against a stop pin 81. In the position of the parts illustrated in Figure 4, which is that occupied in all positions of the cams 27 except the "d" position illustrated in Figure 2, the long arm of the bell crank 78 is in the path of movement of the crank 68 to prevent opening of the barrier valve 65.

When it is desired to convert the apparatus for off-the-floor cleaning, the pedal 47 is actuated until the word "converter" appears in the slot of the rounded portion 50 of the casing 1. When this occurs, the cams 27 will be in the position illustrated in Figure 2. In this position, the shaft 23 is lowered with respect to the bracket 29 and the link 73 is pulled downwardly, rocking the bell crank 78 in a clockwise direction to remove the long arm thereof from the path of movement of the crank 68 and rotating the bell crank 69 in a counter-clockwise direction against the bias of the spring 75 to engage crank 68 and rotate the same clockwise to swing the barrier valve 65 to the open position, illustrated in Figure 3, which permits insertion of the converting tool 61. The slots 72 and 76 in the link 73 provide a lost motion connection between the shaft 23 and the bell cranks 69 and 78. The lost motion connection allows normal adjustment of the shaft 23 without operating the bell cranks. That is, the bell cranks occupy the positions illustrated in Figure 4 as long as the cams 27 occupy the "a," "b" or "c" positions thereof. When the cams 27 are moved to the "d" position, the lost motion connection is taken up and the bell cranks are actuated in the manner explained hereinabove. The long arm of the bell crank 78 normally clears the crank 68 to allow the crank 68 to be moved a small amount by the bell crank 69 while the bell crank 78 is being moved clear of the path of movement of crank 68.

Due to the possibility of injury to surface coverings when the cleaner is converted for off-the-floor cleaning, it is desirable to prevent actuation of the pedal 47 to lower the nozzle at this time. For this purpose, a barrier bar 83 is pivotally mounted upon a stud 84 secured to the side wall of the tunnel 10. The barrier bar 83 has a right angularly bent portion 85 adapted to be moved into the path of motion of a projecting tongue 86 on the slide bar 33. The barrier bar 83 projects through a suitable slot in the partition 3 where it terminates in an angularly bent actuating section 88 extending across a portion of the entrance to the tunnel 10 beneath the converter receiving opening 60 in position to be engaged by a converter 61 when the same is inserted into the tunnel. A torsion spring 89 around the stud 84 normally biases the bar 83 to the position illustrated in Figure 4 in which the bent portion 85 is clear of the path of movement of the tongue 86. Hence, under these conditions, the slide bar 33 may be actuated without interference. When the converter tool 61 is inserted, the rear surface thereof engages the portion 88 of the barrier mechanism, as illustrated in Figures 2 and 4, and rocks the same clockwise to shift the bent portion 85 into the path of movement of the tongue 86 and thus bar further operating motion of the slide bar 33 by the pedal 47. The operative position of the barrier mechanism, in which it prevents operation of the slide bar 33, is illustrated in Figure 2, and the ineffective position of the barrier mechanism is illustrated in Figure 4.

The foregoing construction provides a highly effective means by which the adjustment of the nozzle for various thicknesses of surface coverings and for conversion is readily achieved by actuation of a pedal at the rear of the cleaner body which operates a suitable mechanism to shift the body of the cleaner with reference to the front supported wheels thereof. It is highly desirable to be able to actuate the nozzle adjusting mechanism to the rear of the cleaner as that is most convenient for the operator and is a portion of the cleaner which is readily reached by the operator's toe. It is desirable to raise and lower the nozzle by actuation of the front supporting wheels thereof as this arrangement effects the desired adjustment of the nozzle with a minimum change in the angularity of the nozzle plane with reference to the plane of the supporting surface and thus promotes the most efficient and desirable cleaning conditions. The present construction also positively bars insertion of the converter for off-the-floor cleaning until the nozzle has been adjusted to the converted position which raises the nozzle and brushing structure above the normal cleaning positions. Once the converter is inserted, the adjusting mechanism is locked with the nozzle raised above cleaning position. The foregoing positively prevents operation of the brushing and agitating structures upon a surface covering during off-the-floor cleaning operations.

Although the invention has been described in considerable detail with reference to a single preferred embodiment thereof, it is to be understood that the invention may be practiced by other construction embodying the conception herein disclosed without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. In a suction cleaner having a suction producing means, a surface cleaning nozzle, a duct connecting said nozzle to said suction producing means, said duct having an opening providing for insertion of a tool to convert the cleaner to off-the-floor cleaning operation, and closure means normally closing said opening, the combination of wheel means for supporting the cleaner, means for adjusting said nozzle with respect to said wheel means to a plurality of cleaning positions and to a non-cleaning position, mechanism including a foot pedal for operating said adjusting means successively to place said nozzle in said cleaning and non-cleaning positions and back to said cleaning positions serially in respose to successive depressions of the foot pedal, mechanism for moving said closure means to open position to admit a converting tool to said air duct, and means operated by said adjusting means as said adjusting means is actuated to adjust said nozzle to said non-cleaning position for actuating said mechanism to open said closure means.

2. Apparatus according to claim 1 including means normally locking said closure means in a closed position and means operated by said adjusting means for operating said locking means to release said closure means as said nozzle is adjusted to non-cleaning position.

3. Apparatus according to claim 1 including means for locking said adjusting means against operation to change the adjustment of said nozzle, means biasing said locking means to an inoperative position, and means positioned to be

operated by a converting tool as it is inserted into said duct for actuating said locking means to lock said adjusting means.

4. In a suction cleaner having a suction producing means and a surface cleaning nozzle, an air duct connected to said suction producing means and to said nozzle, means forming an opening into said air duct providing for insertion of a tool for converting the cleaner for off-the-floor cleaning, means normally closing said opening, the combination of rear supporting means on said cleaner, a pair of front wheels for supporting said cleaner, a shaft on which said front wheels are rotatably mounted, means mounting said shaft for movement relative to said nozzle to adjust said nozzle with respect to a surface to be cleaned, a step-by-step mechanism for moving said shaft to adjust said nozzle to a plurality of positions, and means connected to be operated by said step-by-step mechanism for actuating said closing means to open position including a lost motion connection for allowing operation of said step-by-step mechanism without opening said closing means until said nozzle is adjusted to a predetermined position.

5. In a suction cleaner having a suction producing means and a surface cleaning nozzle, an air duct connected to said suction producing means and to said nozzle, means forming an opening into said air duct providing for insertion of a tool for converting the cleaner for off-the-floor cleaning, means normally closing said opening, means barring opening of the closing means, the combination of rear supporting means on said cleaner, a pair of front wheels for supporting said cleaner, a shaft on which said front wheels are rotatably mounted, means mounting said shaft for movement relative to said nozzle to adjust said nozzle with respect to a surface to be cleaned, a step-by-step mechanism connected to move said shaft to adjust said nozzle to a plurality of positions, and means connected to be operated by said step-by-step mechanism for rendering said barring means inoperative and for actuating said closing means to open position including a lost motion means connected to allow operation of said step-by-step mechanism without operating said barring means and said closing means until said nozzle is moved to a predetermined position.

6. Apparatus according to claim 5 including a stop member having a part movable into engagement with a part of said step-by-step mechanism to bar operation thereof, means biasing said stop member to an inoperative position, and means positioned to be operated by a converting tool as it is inserted into said duct for actuating said stop to operative position.

7. In a suction cleaner having a body portion provided with a suction nozzle across the front thereof, an air duct extending rearwardly of said body, a suction producing means positioned rearwardly of said nozzle and communicating with said duct, an upwardly facing opening through the top wall of said body portion to said duct providing for the insertion of a tool to convert the cleaner to off-the-floor cleaning operation, and closure means normally closing said opening, the combination of wheel means for supporting said body portion, means for adjusting said nozzle with respect to said wheel means to cleaning and non-cleaning positions, and a foot pedal mounted on said body portion and connected to actuate said adjusting means, means connected to said foot pedal for actuating said adjusting means successively to place said nozzle in cleaning and non-cleaning positions in response to successive depressions of said foot pedal, mechanism for moving said closure means to open position to admit a converting tool to said air duct, and means actuated by said adjusting means as said adjusting means is actuated by said foot pedal to adjust said nozzle to said non-cleaning position for actuating said mechanism to open said closure means.

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