

June 4, 1940.

W. H. KITTO

2,202,989

SUCTION CLEANER

Original Filed Aug. 24, 1934

3 Sheets-Sheet 1

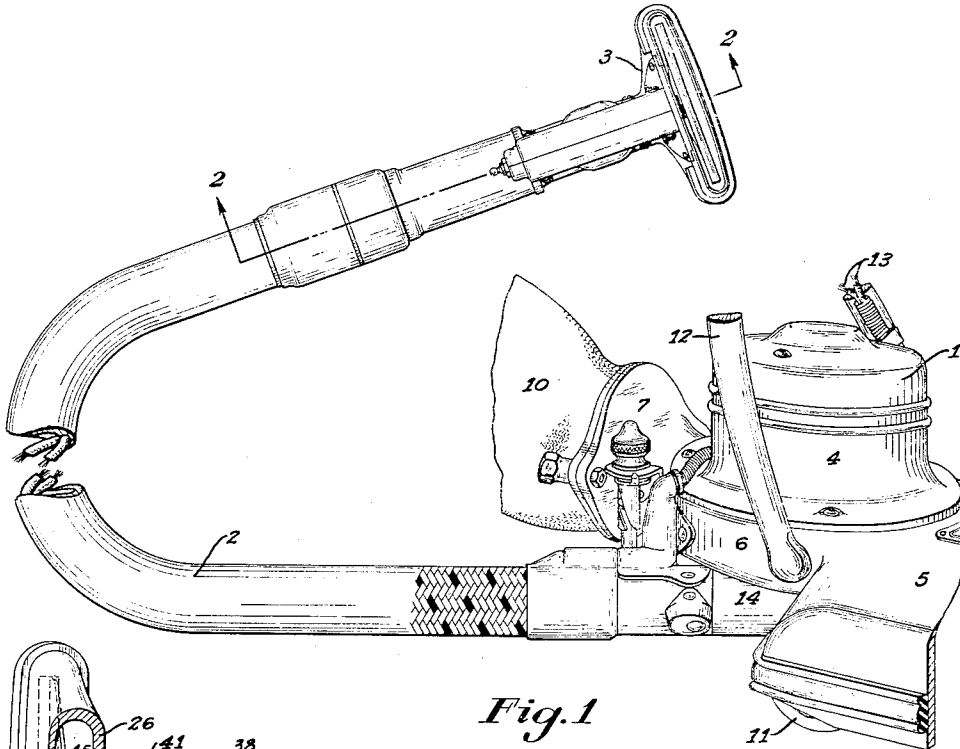


Fig. 1

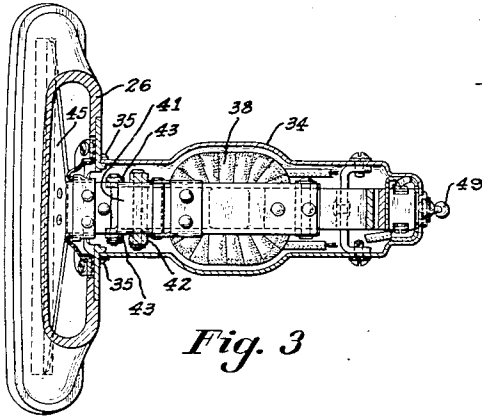


Fig. 3

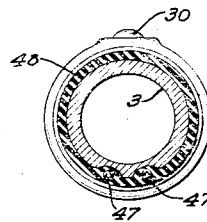


Fig. 4

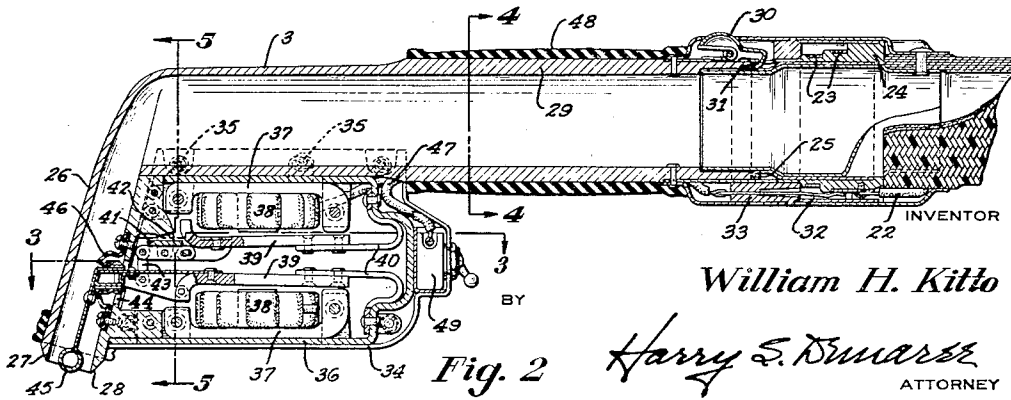


Fig. 2

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SUCTION CLEANER

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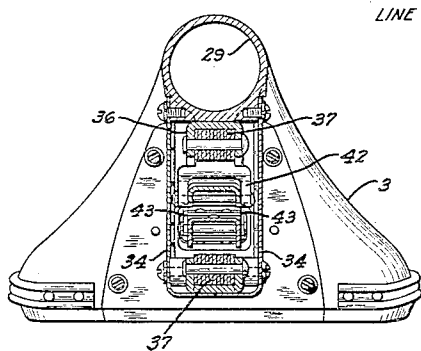


Fig. 5

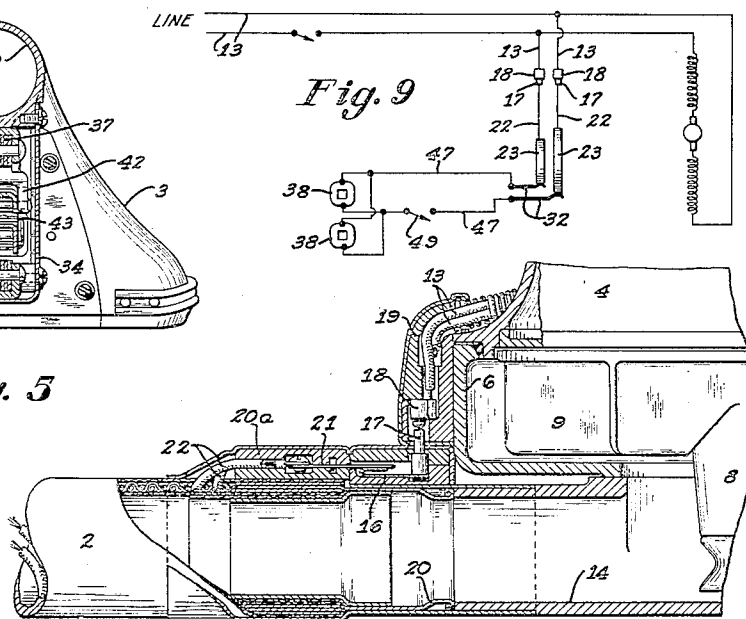


Fig. 6

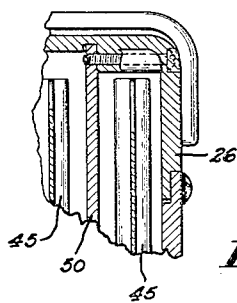


Fig. 8

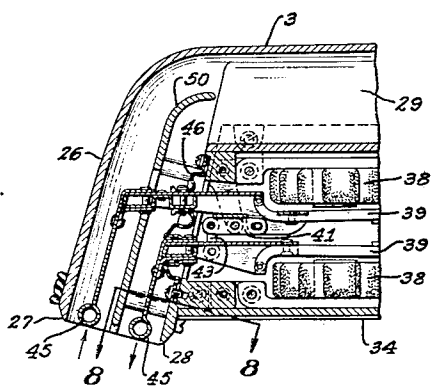


Fig. 7

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Fig. 11

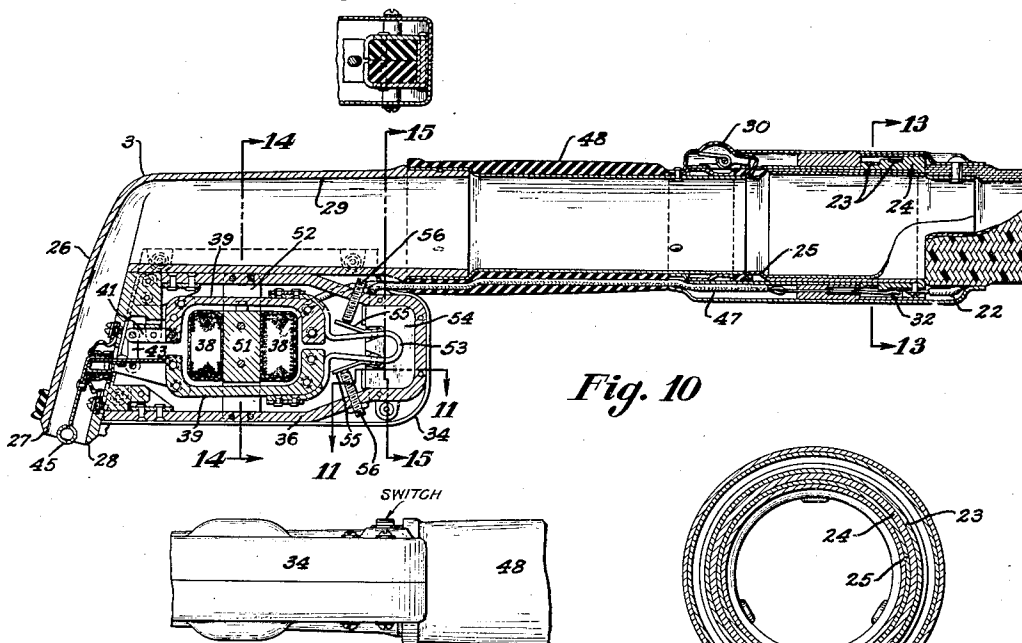


Fig. 10

Fig. 12

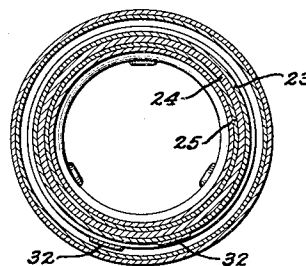


Fig. 13

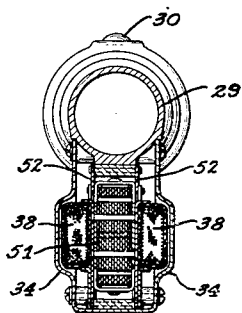


Fig. 14

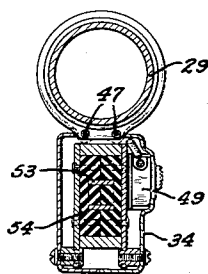


Fig. 15

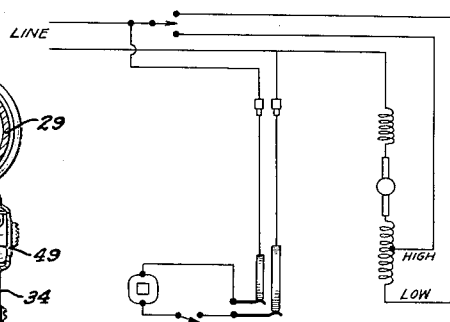


Fig. 16

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2,202,989

SUCTION CLEANER

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Application August 24, 1934, Serial No. 741,195
Renewed June 27, 1938

18 Claims. (Cl. 15—13)

The present invention relates to suction cleaners in general and in particular to a new and improved vibrating agitator for a dusting tool nozzle of a suction cleaner. More specifically the invention comprises an improved combination of electric vibrator and agitating elements in a dusting tool nozzle.

It is an object of the present invention to provide a new and improved dusting tool nozzle.

It is another object of the invention to provide a dusting tool nozzle including surface-agitating means which are driven by reciprocating means of an improved type. A still further object is the provision in a suction cleaner nozzle of a vibrator which is so constructed that the cancellation of equal and opposite forces results in a minimum of vibration transference to the means of support. A still further object is the provision in a suction cleaner of a vibrator in which a plurality of moving parts are so arranged that their force reactions cancel. Still another object is the provision of a suction cleaner dusting tool nozzle in which two armatures move simultaneously in opposite directions and simultaneously reverse their directions of travel. Still another object is the provision of a suction cleaner in which a plurality of surface-agitating elements move simultaneously in opposite directions being reciprocated by vibrating means in which the moving parts also move simultaneously in opposite directions and simultaneously reverse their directions of travel. These and other more specific objects will appear upon reading the following specification and claims and upon considering in connection therewith the attached drawings in which preferred embodiments of the present invention are disclosed.

Referring now to the drawings in which the same reference characters refer to the same parts throughout;

Figure 1 is a showing of a modern suction cleaner combined with dusting tools;

Figure 2 is a section thru the dusting tool nozzle upon the line 2—2 of Figure 1;

Figure 3 is a section thru the vibrator unit mounted on the nozzle, being taken upon the line 3—3 of Figure 2;

Figure 4 is a transverse cross-section through the nozzle upon the line 4—4 of Figure 2;

Figure 5 is a vertical transverse cross-section upon the line 5—5 of Figure 2;

Figure 6 is a fragmentary section at the point of connection of the dusting tool hose to the cleaner proper;

Figure 7 is a partial section, similar to Figure 2, through a second embodiment of the dusting tool nozzle and vibrator combination;

Figure 8 is a fragmentary section upon the line 8—8 of Figure 7;

Figure 9 is a diagrammatic showing of the elec-

trical circuit of the combination suction cleaner and dusting tools;

Figure 10 is a section through a dusting tool nozzle similar to Figure 2 and shows a third preferred embodiment of the invention;

Figure 11 is a section through the vibrator upon the line 11—11 of Figure 10;

Figure 12 is a partial bottom view of the construction shown in Figure 10;

Figure 13 is a transverse section through the connection of the dusting tool nozzle to the dusting tool hose, being taken upon the line 13—13 of Figure 10;

Figure 14 is a transverse section upon the line 14—14 of Figure 10;

Figure 15 is a section upon the line 15—15 of Figure 10;

Figure 16 is a diagrammatic showing of an electrical circuit for the embodiment of the invention shown in Figures 10 to 15, inclusive.

Referring again to the drawings and to Figure 1 in particular, a fragmentary showing of a modern suction cleaner 1 is disclosed. An elongated flexible tubular hose 2 extends from the cleaner and is provided at its end with what is commonly known as a dusting tool nozzle 3. In the operation of the suction cleaner in off-the-floor cleaning, the dusting tool nozzle 3 is thus directly connected to the suction-producing means of the cleaner and upon being moved in contact with the articles to be cleaned performs its cleaning function.

In cleaner 1 the motor casing is indicated by the reference character 4 and houses an unshown driving motor of a common type. The main casing of the machine, including the nozzle 5, the fan chamber 6, and the exhaust outlet 7, supports the motor casing 4 immediately above the fan chamber 6 and the lower end of the motor shaft 8 extends downwardly from casing 4 and passes through the fan chamber where it supports the suction-creating fan 9. The usual cleaner dust bag 10 is removably secured to the exhaust outlet 7 and is adapted to filter suspended foreign matter from the air forced into it by the fan 9. The cleaner is suitably supported by front wheels 11, only one being shown in the drawing, and, as in the usual suction cleaner construction, a handle 12 is provided down which the oncoming power leads 13, 13 extend and which is suitably pivoted to the cleaner casing that the operator may propel the machine.

The nozzle 5 is the main inlet to the suction-creating fan and fan chamber, but, in order that the machine may be used with dusting tools, an auxiliary or secondary inlet 14 is provided which extends to the side of the fan chamber 6 and therebelow, as indicated in Figures 1 and 6. Inlet 14 is provided with an interior seat at its end and on its top surface with contacts 16, 16 and 60

17, 17, there being a pair of each. Contacts 17, 17 extend upwardly into contact with contacts 18, 18, of which only one is shown, which are carried permanently by an insulating body 19 at the side of the fan chamber and which are connected to the power leads 13, 13. Contacts 16, 16 extend outwardly and are so positioned that they are adapted to be contacted by contacts carried by the end of the dusting tool hose.

The inner end of the dusting tool hose, the main body of which is formed of a flexible non-metallic material, is provided with a metallic sleeve 20 which seats in the end of inlet 14 and which is provided on its top surface, exterior of the seat in inlet 14, with contacts 21, 21, of which only one is shown in Figure 6, which are mounted in an insulating body 20a. Contacts 21, 21 and 16, 16 make sliding contact so that hose 2 can readily be disconnected from inlet 14.

Current-conducting wires 22, 22 extend the length of the body of hose 2, being connected at their cleaner ends to the contacts 21, 21 and at the outer end of the hose to contactor rings 23, 23. These rings are mounted upon an insulating body 24 carried by a metallic sleeve 25 which defines the outer end of the hose.

The body of dusting tool nozzle 3 comprises a nozzle mouth 26, having surface-contacting lips 27 and 28, and an angularly disposed elongated tubular conduit portion 29 which encloses and seats on the hose sleeve 25. Unintentional separation of the nozzle and the hose is prevented by a spring-pressed detent 30 carried by portion 29 which locks over a circumferential shoulder 31 on sleeve 25. Spring contacts 32, 32 are carried by an insulating body 33 at the end of portion 29 and are adapted to seat slidably upon the contact rings 23, 23 in any relative angular position of the hose and the nozzle, the two being relatively rotatable.

On the underside of tubular conduit portion 29, and immediately in the rear of nozzle mouth 26, is positioned a vibrator-containing casing 34 which is removably secured to mouth 26 and tubular portion 29 by screws 35, 35 etc. Within the casing 34 is an U-shaped frame 36 which opens toward nozzle mouth 26 and the side arms of which support the pole stacks 37, 37 and windings 38, 38 of a vibrator assembly. The vibrator includes two movable equal-mass armatures 39, 39 which are carried by springs 40, 40 on the U-shaped frame 36, for movement in the same plane toward and from each other. The two armatures are connected through a linkage including an arm 41 pivoted centrally to the rear wall of the nozzle mouth 26 and more specifically to forked depending arms 42 formed thereon. Spaced arms 43, 43 are pivoted at one end of the arm 41 and at their other end to the lower armature 39. The linkage arm 41 which is centrally pivoted to the rigid spaced arms 42, 42 on the nozzle, is connected at its end spaced from arms 43, 43 to the upper movable armature 39 through a pin and slot connection which makes possible the pivotal movement of the armature and of the arm about the different centers.

The nozzle mouth 26 is provided with an aperture 44 in its side adjacent the casing 34 and through this aperture the extension of armature 39 passes. Within the nozzle mouth the extension is connected to and carries a rigid beater element 45 having a rounded surface-contacting portion. To prevent passage of air between vibrator casing 34 and the nozzle a flexible fabric

seal 46 is provided at the opening 44 which is sealed to the moving armature extension and to the adjacent nozzle wall.

Current is conveyed to the vibrator unit from contacts 32, 32 by means of conductors 47, 47 which extend along the conduit 29, being moulded and imbedded in an insulating grip member 48 which surrounds the conduit. Upon entering the casing 34, and before being connected to the vibrator proper, one of the conductors 47 is connected in series with the manually operable switch 49 which is positioned within casing 34 but with its manually operable lever extended therethrough and operable from the exterior thereof. The switch is so placed that with the operator's hand enclosing grip member 48 the switch can be operated by the fingers of that hand.

The electrical circuit embodied in this form of the invention is illustrated in Figure 9 and the reference is here made thereto, the same reference characters referring to the same parts as in the views previously described.

In the operation of this embodiment of the invention upon the closing of the dusting tool switch 49, it being assumed that the switch in series with the incoming power leads 13, 13 to the cleaner proper has previously been closed, electric current passes to the windings 38, 38. Alternating current is assumed. Magnetic fields are immediately set up and the movable armatures 39, 39 are drawn in opposite directions, against the force of springs 40, 40 toward the poles by the magnetic flux to reduce the reluctance of the magnetic path. As the current passes through zero the springs 40, 40 carry the armatures away from the poles and towards each other. Upon the increase in the current from zero to its maximum value in each cycle of the current the armatures are drawn to the pole faces. It is to be noted that this movement and reversal of direction of the two armatures takes place simultaneously and that, being identical and apposed, their movements are opposite and equal. The force of the two armatures is resolved into a single force available at the agitating element 45 through the linkage mechanism comprising the pivoted arms 41 and 43, 43 which transform the direction of the force exerted by upper armature 39 into a force having the same direction as the travel of the lower armature. As a result, the agitating element 45 vibrates relative to the plane of the nozzle lips 27 and 28 to disturb and dislodge foreign matter imbedded in those objects with which the nozzle mouth contacts, the disturbed foreign matter being carried through the nozzle, and to the cleaner proper by way of the hose 2.

Referring now to Figures 7 and 8 in particular, a second preferred embodiment of the invention is disclosed which is like that previously described with the exception that each of the armatures 39, 39 is connected directly to an agitating element 45 which moves in the direction in which it moves, the armatures again being mutually connected by the linkage comprising the arms 41 and 43, 43. The upper armature 39 has been extended into the nozzle and the seal 46 has been enlarged to include both armatures. A further slight difference exists in that the nozzle mouth 26 is divided by a vertical internal wall 50 through which the extension of the upper armature passes, the agitating elements being separated by the wall.

In the operation of this last described embodiment

ment of the invention the armatures of the vibrators are actuated as described in the first embodiment. Vibrating beating blows are delivered to the covering undergoing cleaning with twice the frequency of vibration found in the first embodiment because of the fact that two agitating elements are provided and a blow is delivered to the covering as each armature moves downwardly, the armature and elements moving in opposite directions and simultaneously reversing their directions of travel. The total force of the two armatures moving in opposite directions is effective upon each beater element as the two are interconnected by the linkage comprising the arms 41 and 43, 43.

Referring now to Figures 10 to 16, inclusive, a third preferred embodiment of the invention is disclosed. In this embodiment a single field pole 51 is positioned centrally of the vibrator casing 34, being mounted there by spaced vertical posts 52, 52 which extend between the spaced arms of the U-shaped frame 36. The field winding 38 encircles the pole 51, being carried thereby. The movable armatures 39, 39 are positioned upon the opposite sides of the stator comprising the pole winding, being supported there by a single loop spring 53 which extends rearwardly to be imbedded in a fixed body 54 of a resilient material secured at the rear of the frame. Leaf springs 55, 55 are carried by and extend to the sides of armature-supporting spring 53 which are contacted by adjustable screws 56, 56. Variation of the pressure exerted upon the springs 55, 55 by the screws serves to vary the spring load and to determine the extent of armature movement.

Armatures 39, 39 are connected to a single agitating element 45 within the nozzle, as in the first embodiment, and the upper armature 39 is connected through the pivoted linkage comprising arms 41 and 43, 43. The presence of the rubber body 54 has resulted in the shifting of the controlling switch 49 from the end of the casing 34 to the side, as shown in Figure 15.

In operation this embodiment of the invention functions quite similarly to the first embodiment. Upon the passage of electric current through the cleaner with the dusting tool hose attached thereto, current is carried through the hose by the connections described to the field coil 38. The setting up of the magnetic field causes the movable armatures 39, 39 to move toward each other and toward the pole 51 which is positioned between them. Upon the passage of the current through zero, an alternating current being assumed, the mounting spring 53 moves the armatures apart and the operation is repeated with each cycle of the alternating current or in multiples thereof. The movement of the armatures result in the reciprocation of the beating element 45 in the manner described in the first embodiment. The electrical circuit of this last embodiment of the invention is illustrated in Figure 16.

I claim:

1. In a suction cleaner nozzle unit, air-conducting means adapted to be connected to suction-creating means, a nozzle open to said air-conducting means, a surface-agitating element connected to and positioned to cooperate with said nozzle in the cleaning operation, and means to reciprocate said element at high frequency connected thereto and including a plurality of opposed reciprocating armatures always moving in opposite directions thereby providing cancelling force reactions, whereby said unit other

than said element receives a minimum of vibration.

2. In a suction cleaner unit, air-conducting means adapted to be connected to suction-creating means, a nozzle open to said air-conducting means, an agitating element connected to and arranged to cooperate with said nozzle, and means to reciprocate said element at high frequency, including a stationary part and moving parts actuated thereby and connected to said element, said moving parts including a pair of aligned reciprocating armatures mounted in juxtaposition for movement toward and from each other and constantly moving in opposite directions, whereby a minimum of vibration is imparted to said stationary part.

3. In a suction cleaner unit, air-conducting means adapted to be connected to suction-creating means, a nozzle open to said air-conducting means, an agitating element connected to and arranged to cooperate with said nozzle, and means to reciprocate said element at high frequency, including a stationary part and moving parts actuated thereby and connected to said element, said moving parts including a pair of apposed reciprocating armatures of equal masses mounted for equal displacements and constantly moving in opposite directions, whereby a minimum of vibration is imparted to said stationary part.

4. In a suction cleaner unit, air-conducting means adapted to be connected to suction-creating means, a nozzle open to said air-conducting means, an agitating element adapted to cooperate with said nozzle, and means to reciprocate said element at high frequency, including a stationary part and moving parts electrically actuated thereby, said stationary part being connected to said nozzle, said moving parts being connected to said agitating element and including a pair of connected reciprocating armatures mounted for movement toward and from each other and exerting equal and oppositely directed forces upon said stationary part, whereby said stationary part and said nozzle receive a minimum of vibration.

5. In a suction cleaner unit, suction creating means, air-conducting means connected to said suction creating means, a nozzle open to said air-conducting means, an agitating element operatively related to said nozzle, and means to reciprocate said element at high frequency, including stationary parts and moving parts, said stationary parts including a pair of spaced poles and windings, said moving parts being connected to said element and including an armature for each of said poles, said armatures being aligned and constantly moving in opposite directions and toward and from each other, whereby a minimum of vibration is imparted to said stationary parts.

6. In a suction cleaner unit, suction-creating means, air-conducting means connected to said suction-creating means, a nozzle open to said air-conducting means, an agitating element adapted to cooperate with said nozzle, and means to reciprocate said element at high frequency, including a stationary part and a moving part, said stationary part being mounted on said nozzle and including a pair of spaced poles and windings through which alternating current passes, said moving part being connected to said element and including aligned and apposed armatures movable toward and from said poles and toward and from each other in synchronism and traveling in opposite directions at any given instant, whereby a

minimum of vibration is imparted to said stationary part and to said nozzle.

7. In a suction cleaner unit, air-conducting means connected to said suction-creating means, a nozzle open to said air-conducting means, an agitating element arranged to cooperate with said nozzle, and means to reciprocate said element at high frequency, including a stationary part and a moving part, said stationary part including an alternating current winding and spaced pole faces, said moving part being connected to said element and including aligned armatures upon opposite sides of said winding movable toward and from said pole faces with variations in the magnetic flux, said armatures moving in opposite directions at any given instant and simultaneously reversing their directions of travel, whereby a minimum of vibration is imparted to said stationary part.

8. The construction recited by the preceding claim in which a mechanical linkage connects the two armatures.

9. In a suction cleaner unit, suction-creating means, air-conducting means connected to said suction-creating means, a nozzle open to said air-conducting means, a pair of agitating elements arranged to cooperate with said nozzle, an electric vibrator armature connected to each of said elements, magnetic field-creating means to actuate said armatures in synchronism and in opposite directions, said armatures being aligned, apposed and of equal masses.

10. A suction cleaner nozzle unit including a body, a surface covering agitating element movably mounted relative to said body, and means to reciprocate said element at high frequency with a minimum of vibration transference to said body, said means including a pair of identical armatures, spring means movably mounting said armatures on said body, magnetic-field-creating means positioned between said armatures and adapted to exert simultaneously equal and oppositely directed energizing and moving forces thereon, said armatures being connected to said agitating means.

11. A suction cleaner unit including a nozzle having a mouth portion and an angularly extending conduit portion, agitating means positioned in said mouth and adapted to contact a surface undergoing cleaning, and means to reciprocate said agitating means positioned in the rear of said mouth and under said conduit, said actuating means including a stationary-magnetic-field-producing means carried by said nozzle and a pair of juxtapositioned equal mass vibrating armatures mounted for synchronous movement toward and from each other under the influence of said field-producing means, said agitating means being connected to said armatures.

12. In a suction cleaner unit, air-conducting means adapted to be connected to suction-creating means, a nozzle open to said air-conducting means, an even number of reciprocating agitating elements positioned to cooperate with said nozzle, electrical vibrating means to vibrate said elements in synchronism and in pairs the individual members of which are displaced 180 degrees in time-phase relationship, whereby the reactions caused by the movements of said elements tend to cancel.

13. In a suction cleaner unit, air-conducting means adapted to be connected to suction-creating means, a nozzle open to said air-conduct-

ing means, an even number of reciprocating agitating elements positioned to cooperate with said nozzle, electrical vibrating means to vibrate said elements, said means including a separate movable vibrator armature connected to each of said elements, said armatures being mounted for movement in opposite directions, and stationary means to vibrate said armatures and the elements connected thereto with said armatures and their connected elements moving in opposite directions at all times, whereby the reaction forces set up by the movements of said parts tend to cancel.

14. In a suction cleaner unit, air-conducting means adapted to be connected to suction-creating means, a nozzle open to said air-conducting means, a vibrating agitating element operatively positioned relative to said nozzle, an electric vibrator mounted on said nozzle and including a vibrating armature connected to said element, a resilient spring movably mounting said armature, resilient means contacting said spring, and manually adjustable means to load said resilient means to vary the operating characteristics of said vibrator.

15. In a suction cleaner unit, air-conducting means adapted to be connected to suction-creating means, a nozzle open to said air-conducting means, a vibrating agitating element operatively positioned relative to said nozzle, an electric vibrator mounted on said nozzle and including a vibrating armature connected to said element, a resilient spring movably mounting said armature, a second spring in contact with said resilient spring, and a manually adjustable screw adapted to contact and load said second spring to determine the extent of armature movement.

16. In a suction cleaner, a body, a surface-contacting-and-agitating element movably mounted on said body for movement toward and from a surface covering undergoing cleaning, and means to reciprocate said element at high frequency connected thereto and comprising a plurality of aligned oppositely moving driving elements so arranged that their forces are resolvable in a common plane whereby force reactions transmitted to said body are cancellative to reduce the vibration thereof to a minimum.

17. In a suction cleaner, a body, a surface-contacting-and-agitating element movably mounted on said body for movement toward and from a surface covering undergoing cleaning, and means to reciprocate said element at high frequency connected thereto and comprising apposed reciprocating driving elements always moving in opposite directions toward and from each other thereby providing cancelling force reactions, whereby a minimum of vibration is imparted to said body.

18. In a suction cleaner, a body including a nozzle, surface-contacting-and-agitating means movably positioned in said nozzle for movement relative to a surface covering undergoing cleaning, and means mounted on said body outside said nozzle and connected to said agitating means and comprising a plurality of driving elements which move oppositely and toward and from each other so as to provide cancellative force reactions to reduce to a minimum the vibration transferred to said body.

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