

July 6, 1943.

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2,323,554

VACUUM CLEANING APPARATUS

Filed April 19, 1941

2 Sheets-Sheet 1

Fig. 1

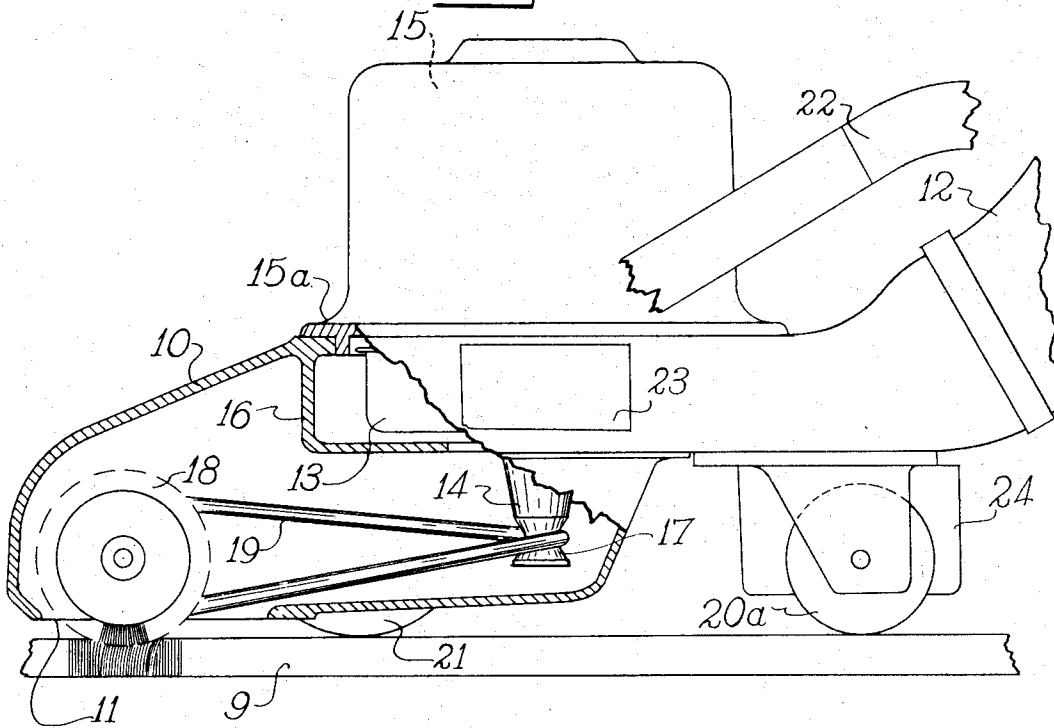
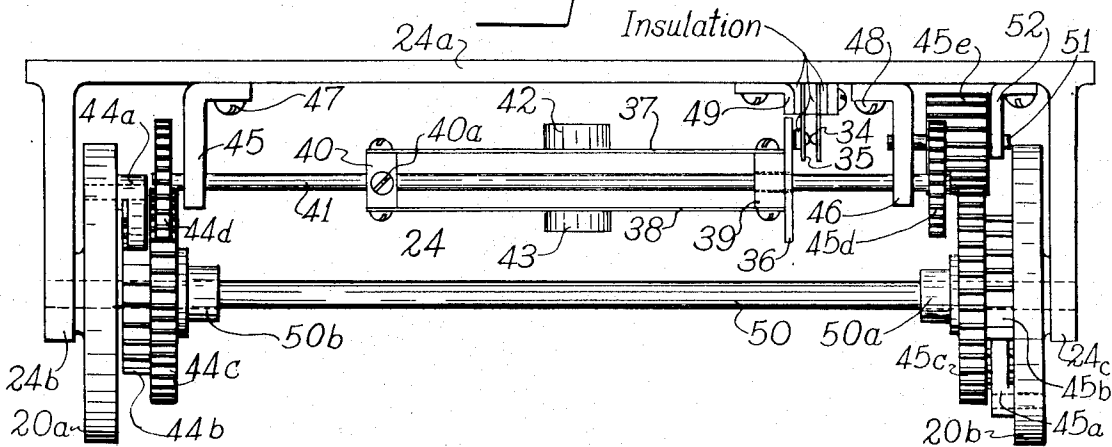


Fig. 2



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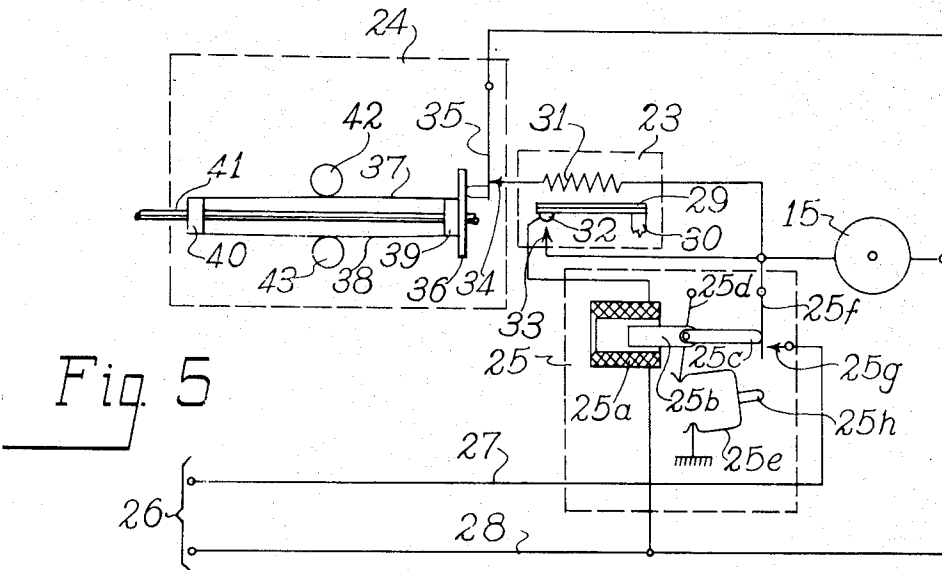
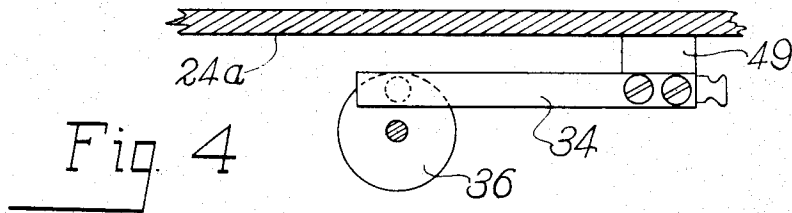
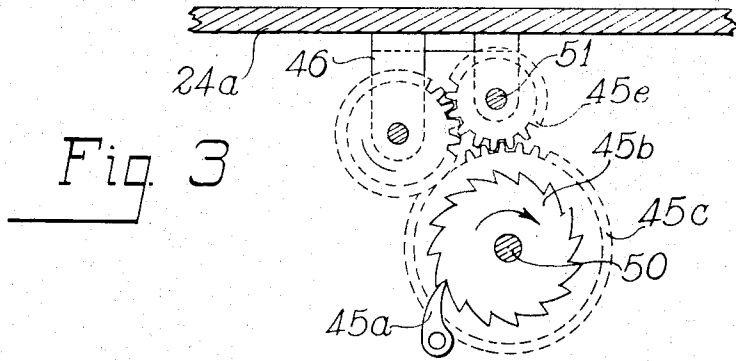
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UNITED STATES PATENT OFFICE

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VACUUM CLEANING APPARATUS

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Application April 19, 1941, Serial No. 389,287

21 Claims. (Cl. 15—8)

The present invention relates to improvements in vacuum cleaning apparatus and, more particularly, to improvements in vacuum cleaners of the household type conventionally used for cleaning rugs and other household articles. A cleaner of the type mentioned conventionally includes a nozzle adapted for movement relative to a surface to be cleaned and a motor driven fan for creating a suction within the nozzle which serves to pull dust, dirt and other foreign matter from the surface being cleaned and to convey the same to a removable collecting bag. In the usual cleaner there is also provided agitating means in the form of a brush or beater, mounted within the nozzle of the cleaner, for beating the surface of the article being cleaned, thereby to facilitate the removal of dirt therefrom by the air stream created by the suction fan. If, as is frequently the case, the cleaner is, while operating, left standing for a considerable period of time on a surface being cleaned, the action of the air stream, the agitating means, or both, will damage the portion of the surface which is exposed to the action of the cleaner.

It is an object of the present invention, therefore, to provide improved vacuum cleaning apparatus of the general form briefly described above, which is automatically controlled in a manner such that the possibility of damage to the surface being cleaned, occasioned by carelessness on the part of the operator in leaving the cleaner standing in one position, is entirely eliminated.

It is a still further object of the invention to provide an arrangement of the character described, which permits the movement of the cleaner over the surface being cleaned to be stopped for short intervals, during which it may be moved from place to place or furniture may be moved without arresting the operation of the cleaner.

It is still another object of the invention to provide an arrangement of the character described, wherein the operation of the cleaner may be restarted immediately after the operation thereof is automatically stopped.

It is another and more specific object of the invention to provide apparatus of simple, economical and compact construction for preventing the operation of the suction creating means, agitating means, or both, for more than a predetermined time interval after the cleaner has been left standing in one position.

In brief, the objects as set forth above are realized in accordance with the present invention by providing vacuum cleaning apparatus of the form briefly described, which includes means controlled by the relative movement between the suction nozzle and a surface being cleaned for controlling the operation of the suction creating means and, if provided or desired, the agitating

means. In the illustrated embodiment of the invention, a roller actuated switch and timing means are provided, which elements cooperate automatically to interrupt the operating circuit of the driving motor of the cleaner a predetermined time interval after movement of the nozzle over the surface undergoing cleaning is arrested. The time interval as measured by the timing device permits the cleaner to be stopped for short intervals without any pause in the operation thereof.

The novel features believed to be characteristic of the invention are set forth with particularity in the appended claims. The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the specification taken in connection with the accompanying drawings in which Fig. 1 is a view, partially in section, illustrating a vacuum cleaner of the form briefly described above, having the features of the present invention embodied therein; Figs. 2, 3 and 4 illustrate the details of one of the elements embodied in the cleaner shown in Fig. 1; and Fig. 5 illustrates the control circuit for the cleaner.

Referring now more particularly to Fig. 1 of the drawings, the vacuum cleaner there illustrated comprises a suction nozzle in the form of a lower housing member 10 having along its bottom portion a suction orifice 11 through which dust, dirt or other foreign matter extracted by the air stream from the rug 9 is conducted to a removable dust collecting bag 12. For the purpose of creating a suction within the nozzle 10 there is provided means comprising a fan 13 carried by the driving shaft 14 of an electric motor 15, which motor is enclosed by a housing member 15a in the manner illustrated. The member 15a is flanged along its lower edge and rests in an enlarged opening provided in the upper portion of the housing member 10 to provide an airtight joint between the two members.

More specifically, the fan 13 is arranged to rotate in a partially enclosed space formed by the bottom portion of the motor housing and the downwardly projecting inturned portion 16 of the member 10. Projecting through the open bottom portion of the portion 16 of the member 10 is a pulley 17 which is mounted for rotation with the motor shaft 14. A brush 18 is provided which is mounted for rotation within the housing member 10 in any desired manner, and is arranged to be driven from the motor 15 by an endless belt 19 which extends between the pulley 17 and a similar pulley provided on the shaft of the brush. This brush or agitator is provided with bristles around its peripheral surface, which are arranged to extend through the orifice 11 to contact the surface being cleaned, thereby to loosen the dirt embedded in the surface so

that it may easily be removed by the air stream. The cleaner is supported on rollers 20 and 21 carried by the housing member 10 and is adapted to be moved over a rug, or the like, by a handle 22. This handle is provided with a bail which is pivotally mounted at its extremities on the sides of the housing member 10.

Referring now to Figs. 2, 3, 4 and 5 of the drawings, there is illustrated the electric circuit apparatus for controlling the driving motor 15. In general, this apparatus comprises timing means in the form of a thermal switch 23, a roller actuated switch 24 for controlling the switch 23 and an operating switch 25 which may be mounted on the handle 22 of the cleaner in the conventional manner. These elements cooperate to control the energization of the motor 15 from the source of current indicated at 26, current being conducted from this source to the motor over the conductors 27 and 28. More specifically considered, the thermal switch 23 comprises a bimetallic strip 29 having one end fixedly mounted upon a base member 30 and its other end free to move in a downward direction from the position shown in the drawings when exposed to heat occasioned by the energization of an associated heating element 31. This heating element may be in the form of resistance wire wound around the bimetallic element 29. Mounted on the free end of the element 29 is a contact 32 which is adapted to engage an associated fixedly mounted contact 33 when the free end of the bimetal element is flexed downward.

The handle switch 25 is of the snap operating type and is equipped with a small trip solenoid 25a which, in cooperation with a solenoid plunger 25b, is controllable by the thermal switch 23 to trip the operating element 25c of the handle switch to its open circuit position. More specifically, the operating element 25c and the plunger 25b are carried by a link 25d which, in cooperation with a U-shaped over center spring 25e, functions to snap the operating element between its two positions. This operating element engages a movable contact carrying element 25f which is biased by a spring, not shown, away from an associated fixed contact 25g. For the purpose of manually operating the link 25d between its two positions, an operating finger 25h is provided which is centrally mounted along the base of the U-shaped spring 25e.

The energization of the heater 31 is under the control of the roller actuated centrifugal switch 24, the details of which are best shown in Figs. 2, 3 and 4. Briefly described, this switch comprises a pair of normally engaged contact springs 34 and 35 which are biased to move out of engagement when released by the friction plate 36 of a fly ball assembly of conventional arrangement. The assembly further comprises a pair of leaf springs 37 and 38, the right ends of which are secured to a collar 39 which carries the friction plate 36. This collar is free to slide along a drive shaft 41, which is arranged to be driven by the rollers 20a and 20b. The left ends of the two leaf springs are anchored to a second collar 40 which is mounted for rotation with the drive shaft 41 by means of a set screw 40a. This drive shaft is journaled in bearing brackets 45 and 46 which are mounted upon the switch base 24a by means of screws 47 and 48. The under side of the base 24a also carries the contact springs 34 and 35 which are insulated from each other and from the base by suitable insulating means included in the mounting assembly 49. The two

leaf springs 37 and 38 carry fly balls 42 and 43, respectively, which are thrown outward by centrifugal force when the shaft 41 is rotated, and serve to slide the collar 39 along the shaft 41 toward the collar 40 to permit separation of the contact springs 34 and 35.

The two ratchet and gear mechanisms 44 and 45 are arranged to impart continuous rotation to the shaft 41 in the same direction as the cleaner is moved forward and backward over the surface being cleaned. More specifically, the roller 20b is arranged to rotate the shaft 41 in a counter-clockwise direction as viewed from the left end of Fig. 2 when the cleaner is moved forward. The roller 20a is arranged to rotate the shaft 41 in the same direction when the cleaner is moved backward over the surface being cleaned. To this end, drive connections 44 and 45 are provided between the shaft 41 and the rollers 20a and 20b, respectively. Briefly described, the drive connection 44 comprises a pawl 44a carried by the roller 20a and spring biased to engage the teeth of a ratchet wheel 44b which is mounted for rotation with a gear 44c. This gear meshes with a second spur gear 44d mounted on the left end of the shaft 41. The drive connection 45 similarly comprises a pawl 45a carried by the roller 20b and spring biased to engage the teeth of a ratchet wheel 45b which is mounted for rotation with a gear 45c. This gear is arranged to drive a gear 45d mounted upon the right end of the drive shaft 41 through an idler gear 45e. The gears 44c and 45c are of the same size and have the same number of teeth. Similarly, the gears 44d, 45d and 45e are of the same size and have the same number of teeth. The mounting assembly for the enumerated gears and rollers includes a shaft 50 which extends between and is secured at its ends to the downwardly extending end portions 24b and 24c of the base 24a. The rollers 20a and 20b, the ratchet wheels 44b and 45b, and the gears 44c and 45c are all rotatably mounted on the shaft 50. Collars 50a and 50b are mounted upon the shaft 50 to restrain the gears 44c and 45c against lateral movement. The idler gear 45e is mounted upon a shaft 51 which is journaled in the bearing bracket 46 and a third bearing bracket 52, also mounted on the underside of the base 24a.

In considering the operation of the apparatus, it may be assumed the handle switch 25 is snapped to its closed circuit position with the cleaner standing at rest on a surface to be cleaned, such, for example, as the rug 9. When this switch is operated, a circuit is completed for energizing the motor 15, this circuit extending from one side of the alternating current source 26 by way of the conductor 27, the engaged contact elements 25g and 25f, the windings of the motor 15 and the conductor 28 to the opposite terminal of the source 26. Thus, the operation of the motor 15 to drive the fan 13 and the agitating means 18 is initiated. Since, with the cleaner at rest, the elements of the roller actuated switch 24 occupy the positions shown in Fig. 2 of the drawings, a circuit is also completed for energizing the heater 31, this circuit extending from one side of the source 26 by way of the conductor 27, the contact elements 25g and 25f, the heater 31, the contact springs 34 and 35, and the conductor 28 to the opposite terminal of the source 26. The heating of the bimetal strip 29 occasioned by the energization of the heater 31 causes the free end of this strip to move in a di-

rection to bring the contacts 32 and 33 into engagement. The element 23 is so constructed, however, that continued energization of the heater 31 for a predetermined time interval is required before the strip 29 is moved sufficiently to close the contacts 32 and 33. This interval may be of any desired length, although preferably is about sixty seconds. If desired, the fixed contact 33 of the thermal switch 23 may be mounted upon an adjustable screw, not shown, in order to permit the measured time interval to be varied in accordance with individual requirements. In normal use, the cleaner is moved forward and backward across the surface being cleaned almost immediately after the motor 15 starts to function. Incident to such movement, and irrespective of its direction, the roller actuated switch 24 functions to open the above-traced operating circuit for the heater 31. Thus, as the cleaner is moved forward across a rug or other surface being cleaned, rotary movement is imparted to the shaft 41 by the roller 20b through the drive connection 45. More specifically, the pawl 45a engages one of the teeth of the ratchet wheel 45b to lock the roller 20b and the gear 45c against relative movement, immediately clockwise rotation of the rollers 20a and 20b, as viewed from the right end of Fig. 2, is started. As the gear 45c continues to rotate with the roller 20b, clockwise rotation is imparted to the drive shaft 41 through this gear, the idler gear 45e and the drive gear 45d. Preferably, a relatively high gear ratio between the gear 45c and the gears 45d and 45e is employed, so that the speed of rotation of the drive shaft 41 is considerably above that of the roller 20b. As the shaft 41 rotates, the balls 42 and 43 are thrown outward by centrifugal force to draw the collar 39 and friction plate 36 away from the contact spring 35 toward the collar 40. In response to this movement of the friction plate 36, the contact springs 34 and 35 are disengaged to interrupt the above-traced circuit for energizing the heater 31.

The rotation of the shaft 41 is also imparted to the gear 44c and the ratchet wheel 44b through the drive gear 44d, but the direction of rotation of this ratchet wheel is such that the pawl 44a rides over the teeth thereof. Thus, the mechanism is not locked against operation, due to the relative movement between the ratchet wheel 44b and its associated driving roller 20a, during forward movement of the cleaner.

Each time the cleaner is moved in the reverse direction, i. e. backward, the rotation of the shaft 41 in the same direction is continued through the driving connection 44 between this shaft and the roller 20a. Thus, each time counter-clockwise rotation of the roller 20b is started, as viewed from the right end of Fig. 2, the pawl 44a engages one of the teeth of the ratchet wheel 44b to lock the roller 20a and the gear 44c against relative rotation. The gear 44c meshing with the drive gear 44d serves to continue the clockwise rotation of the shaft 41. During the continued rotation of this shaft the gear 45c and the ratchet wheel 45b continue to be driven in a clockwise direction through the gears 45d and 45e. The roller 20b is at this time revolving in a counter-clockwise direction. During such relative movement between the gear 45c and the roller 20b the pawl 45a rides over the teeth of the ratchet wheel 45b and, accordingly, the mechanism is not locked against operation.

Each time the direction of movement of the cleaner is changed, the rotation of the rollers 20a

and 20b is momentarily arrested. During each such transition period, the mechanical inertia of the rotating system serves to continue the rotation of shaft 41 for an interval somewhat in excess of the period ordinarily required for a change in the direction of movement of the cleaner. Each time this occurs, both of the pawls 44a and 45a ride over the teeth of their respective associated ratchet wheels 44b and 45b. In other words, the ratchet wheels over-run their respective associated pawls to permit the continued free rotation of the shaft 41. It will be understood from the above explanation that the contact springs 34 and 35 are not moved into engagement to energize the heater 31 during the short intervals when the movement of the cleaner over the rug is stopped in changing the direction of movement thereof.

When movement of the cleaner over the rug is arrested, the shaft 41 continues to rotate for a short interval and then gradually slows to a stop. Incident to the final movement of the shaft the springs 37 and 38 pull the balls 42 and 43 toward the shaft and slide the friction plate 36 to the right to close the contact springs 34 and 35. When these springs are moved into engagement, a circuit including the contacts 25f and 25g, and the conductors 27 and 28, is completed for energizing the heater 31. Under the influence of the heat produced by the heater 31, the bimetal strip 29 is flexed downward. Assuming that the movement of the cleaner is not restarted, the contact 32 is moved by the bimetal strip 29 to engage the contact 33 a predetermined time interval after the heater 31 is energized. With the two contacts 32 and 33 engaged, a circuit including the conductors 27 and 28 and the contacts 25f and 25g is completed for energizing the solenoid magnet 25a. When this magnet is energized, the solenoid plunger 25b is pulled into the winding 25a to snap the link 25d and the contact controlling element 25c to the open circuit position wherein the contacts 25f and 25g are disengaged. As these contacts are opened the motor 15, the heater 31 and the winding 25a are all deenergized. Immediately the heater 31 is deenergized, the bimetal strip 29 starts to cool so that only a few seconds after the operation of the cleaner is automatically arrested in the manner just explained, the switch 25 may be manually reoperated to its closed circuit position without reenergizing the winding 25a. In this regard it will be apparent that if the operation of the machine is manually restarted shortly after its operation is automatically arrested, the cooling of the bimetal strip 29 will continue as the cleaner is moved over the rug. Thus, the roller actuated switch 24 functions to hold the circuit for energizing the heater 31 open so long as the cleaner is being used. It will also be understood that if movement of the cleaner is restarted during a timing period when the heater 31 is energized, the switch 24 functions to deenergize the heater so that the bimetal strip may be flexed back to its normal shape during the continued use of the cleaner. Thus, provisions are made for preventing the false operation of the apparatus provided to automatically arrest the operation of the cleaning facilities and for insuring a measured time interval of substantially fixed duration.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it

is contemplated to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

I claim:

1. Vacuum cleaning apparatus comprising, in combination, a nozzle adapted to be moved over a surface to be cleaned, means for producing a cleaning action in the area of said surface which registers with the opening of said nozzle, an electric motor for driving said cleaning means, contacts having open and closed circuit settings, means operated only in response to sustained movement of said nozzle over said surface for holding said contacts in one of said settings, means responsive to the discontinuance of movement of said nozzle over said surface for operating said contacts to the other of said settings, and means including a circuit which comprises said contacts for controlling the operation of said motor to drive said cleaning means.
2. Vacuum cleaning apparatus comprising, in combination, a nozzle adapted to be moved over a surface to be cleaned, means for creating a suction within said nozzle, an electric motor for driving said suction creating means, said motor being operative to drive said suction creating means so long as relative movement occurs between said nozzle and said surface, and electric circuit means controlled by relative movement between nozzle and said surface for rendering said motor inoperative to drive said suction creating means when movement of said nozzle over said surface is arrested.
3. Vacuum cleaning apparatus comprising, in combination, a nozzle adapted for movement relative to a surface to be cleaned, agitating means mounted within said nozzle, means for creating a suction within said nozzle, an electric motor for driving said agitating means and said suction creating means, said motor being operative to drive said agitating means and said suction creating means so long as relative movement occurs between said nozzle and said surface, and electric circuit means controlled by relative movement between said nozzle and said surface for rendering said motor inoperative to drive said suction creating means and said agitating means when movement of said nozzle over said surface is arrested.
4. Vacuum cleaning apparatus comprising, in combination, a nozzle adapted to be moved over a surface to be cleaned, agitating means mounted within said nozzle, an electric motor for driving said agitating means so long as said nozzle is moved over said surface, and electric circuit means operative in response to the discontinuance of the movement of said nozzle over said surface for rendering said motor inoperative to drive said agitating means.
5. Vacuum cleaning apparatus comprising, in combination, a nozzle adapted to be moved over a surface to be cleaned, means for creating a suction within said nozzle, normally inactive timing means, means operative in response to the discontinuance of movement of said nozzle over said surface for initiating the operation of said timing means, and means controlled by said timing means for arresting the operation of said suction creating means a predetermined time interval after operation of said timing means is initiated.
6. Vacuum cleaning apparatus comprising, in combination, a nozzle adapted to be moved over a surface to be cleaned, agitating means mounted within said nozzle, power means for driving said agitating means, means for creating a suction within said nozzle, normally inactive timing means, means operative in response to the discontinuance of movement of said nozzle over said surface for initiating the operation of said timing means, and means controlled by said timing means for arresting the operation of said suction creating means and said agitating means a predetermined time interval after operation of said timing means is initiated.
7. Vacuum cleaning apparatus comprising, in combination, a nozzle adapted for movement relative to a surface to be cleaned, agitating means mounted within said nozzle, power means for driving said agitating means, normally inactive timing means, means operative in response to the discontinuance of said relative movement for initiating the operation of said timing means, and means controlled by said timing means for arresting the operation of said agitating means a predetermined time interval after operation of said timing means is initiated.
8. Vacuum cleaning apparatus comprising, in combination, a nozzle adapted to be moved over a surface to be cleaned, a fan for creating a suction within said nozzle, a motor for driving said fan, an operating circuit for said motor, means for interrupting said circuit, said means being inoperative so long as relative movement occurs between said nozzle and said surface, and means including a time delay device operative in response to the discontinuance of said relative movement for rendering said first-mentioned means operative a short time interval after relative movement between said nozzle and said surface is arrested.
9. Vacuum cleaning apparatus comprising, in combination, a nozzle adapted to be moved over a surface to be cleaned, a fan for creating a suction within said nozzle, a motor for driving said fan, an operating circuit for said motor, timing means comprising a thermal element and a heater for said thermal element, said timing means also including contacts controlled by said element for interrupting said operating circuit a predetermined time interval after said heater is energized, an operating circuit for said heater, and means for completing said last-named circuit only when movement of said nozzle over said surface is discontinued.
10. In a vacuum cleaner, a nozzle adapted to be moved over a surface to be cleaned, means for producing a cleaning action in the area of said surface which registers with the opening of said nozzle, an electric motor for driving said cleaning means and electric circuit means controlled by relative movement between said cleaner and said surface for automatically rendering said motor inoperative to drive said cleaning means when movement of said nozzle over said surface is arrested.
11. In a vacuum cleaner, a nozzle adapted to be moved over a surface to be cleaned, means for producing a cleaning action in the area of said surface which registers with the opening of said nozzle, a normally inactive device operative to measure a predetermined time interval, means for automatically initiating the operation of said device when movement of said nozzle over said surface is arrested, and means controlled by said device for arresting the operation of said first-named means at the end of said time interval.
12. In a vacuum cleaner which includes a nozzle adapted to be moved back and forth over a surface to be cleaned, a roller actuated by

movement of the cleaner over said surface, means for producing a cleaning action in the area of said surface which registers with the opening of said nozzle, electric circuit means operative automatically to arrest the operation of said last-named means, and means controlled by said roller for preventing the operation of said electric circuit means so long as said nozzle is being moved back and forth over said surface.

13. In a vacuum cleaner, a nozzle adapted to be moved over a surface to be cleaned, a roller actuated by movement of the cleaner over said surface, means for producing a cleaning action in the area of said surface which registers with the opening of said nozzle, a timing device operative to measure a predetermined time interval, means controlled by said timing device for automatically arresting the operation of said last-named means after said interval is measured by said timing device, and means controlled by said roller for rendering said timing device inactive so long as said nozzle is being moved over said surface.

14. In a vacuum cleaner which includes a nozzle adapted to be moved back and forth over a surface to be cleaned, a pair of rollers actuated by movement of the cleaner over said surface, means for producing a cleaning action in the area of said surface which registers with the opening of said nozzle, electric circuit means operative automatically to arrest the operation of said last-named means, and means controlled by one of said rollers when said cleaner is moved over said surface in one direction and by the other of said rollers when said cleaner is moved over said surface in the opposite direction for preventing said electric circuit means from operating so long as said nozzle is moved back and forth over said surface.

15. In a vacuum cleaner, a nozzle adapted to be moved over a surface to be cleaned, a pair of rollers actuated by movement of the cleaner over said surface, means for producing a cleaning action in the area of said surface which registers with the opening of said nozzle, a timing device operative to measure a predetermined time interval, means controlled by said timing device for automatically arresting the operation of said last-named means after said interval is measured by said timing device, and means controlled by one of said rollers when said cleaner is moved over said surface in one direction and by the other of said rollers when said cleaner is moved over said surface in the opposite direction for preventing said timing device from operating so long as said nozzle is moved over said surface.

16. In a vacuum cleaner, a nozzle adapted to be moved over a surface to be cleaned, a roller actuated by movement of the cleaner over said surface, means for producing a cleaning action in the area of said surface which registers with the opening of said nozzle, a thermal relay comprising a bi-metal timing element and a heater, a circuit for energizing said heater, means controlled by said element for automatically arresting the operation of said last-named means a predetermined time interval after said heater is energized, and means controlled by said roller for holding said circuit open so long as said nozzle is being moved over said surface.

17. In a vacuum cleaner, a nozzle adapted to be moved over a surface to be cleaned, a roller actuated by movement of the cleaner over said surface, means for producing a cleaning action

in the area of said surface which registers with the opening of said nozzle, a thermal relay comprising a bi-metal timing element and a heater, a circuit for energizing said heater, means controlled by said element for automatically arresting the operation of said last-named means and for interrupting said circuit a predetermined time interval after said heater is energized, and means controlled by said roller for holding said circuit open so long as said nozzle is being moved over said surface.

18. In a vacuum cleaner, a nozzle adapted to be moved over a surface to be cleaned, a pair of rollers actuated by movement of the cleaner over said surface, means for producing a cleaning action in the area of said surface which registers with the opening of said nozzle, a thermal relay comprising a bi-metal timing element and a heater, a circuit for energizing said heater, means controlled by said element for arresting the operation of said last-named means a predetermined time interval after said heater is energized, and means controlled by one of said rollers when said cleaner is moved over said surface in one direction and by the other of said rollers when said cleaner is moved over said surface in the opposite direction for holding said circuit open so long as said nozzle is moved over said surface.

19. In a vacuum cleaner, a nozzle adapted to be moved over a surface to be cleaned, a pair of rollers actuated by movement of the cleaner over said surface, means for producing a cleaning action in the area of said surface which registers with the opening of said nozzle, a thermal relay comprising a bi-metal timing element and a heater, a circuit for energizing said heater, means controlled by said element for arresting the operation of said last-named means and for interrupting said circuit a predetermined time interval after said heater is energized, and means controlled by one of said rollers when said cleaner is moved over said surface in one direction and by the other of said rollers when said cleaner is moved over said surface in the opposite direction for holding said circuit open so long as said nozzle is moved over said surface.

20. In a vacuum cleaner which is adapted to be moved back and forth over a surface to be cleaned and includes means for exerting a cleaning action on the surface, an electric motor for driving said cleaning means, electric circuit means operative in response to a discontinuance of the movement of said cleaner over said surface for automatically rendering said motor inoperative to drive said cleaning means, and means for preventing said last-named means from operating during the momentary stoppage of said cleaner which occurs incident to a reversal in the direction of movement of said cleaner over said surface.

21. In a vacuum cleaner which is adapted to be moved over a surface to be cleaned and includes means for exerting a cleaning action on the surface, an electric motor for driving said cleaning means, a circuit for energizing said motor, automatic means for opening said motor circuit when the motor has been running a predetermined interval with the cleaner idle, and means for preventing the opening of said circuit by said automatic means when the cleaner is moved at intervals less than said predetermined interval.

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