March 7, 1944. D. O. BAIRD 2,343,732

VACUUM CLEANING APPARATUS

Filed Oct. 2, 1941 2 Sheets-Sheet 1

Fig. 1

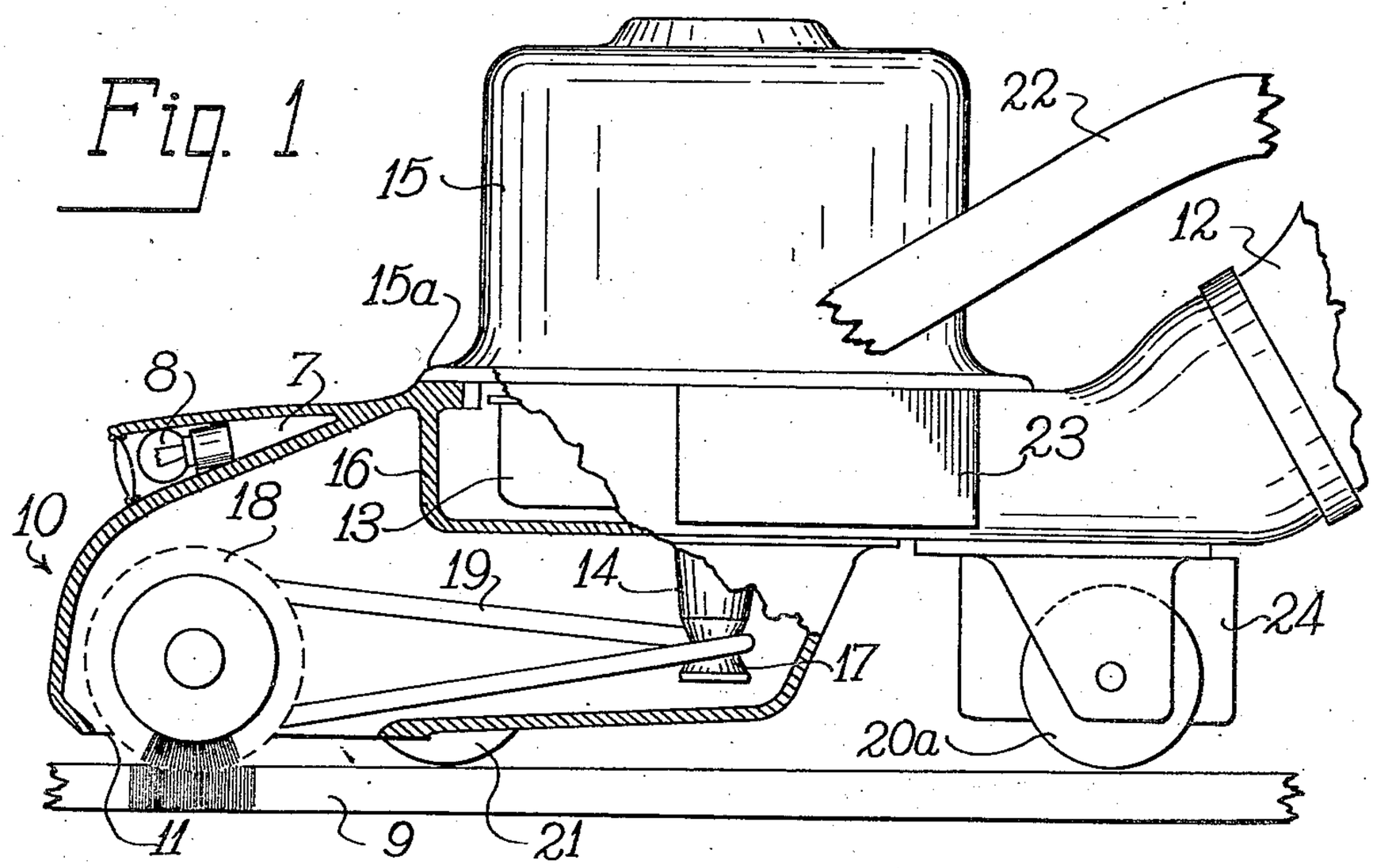

Fig. 2

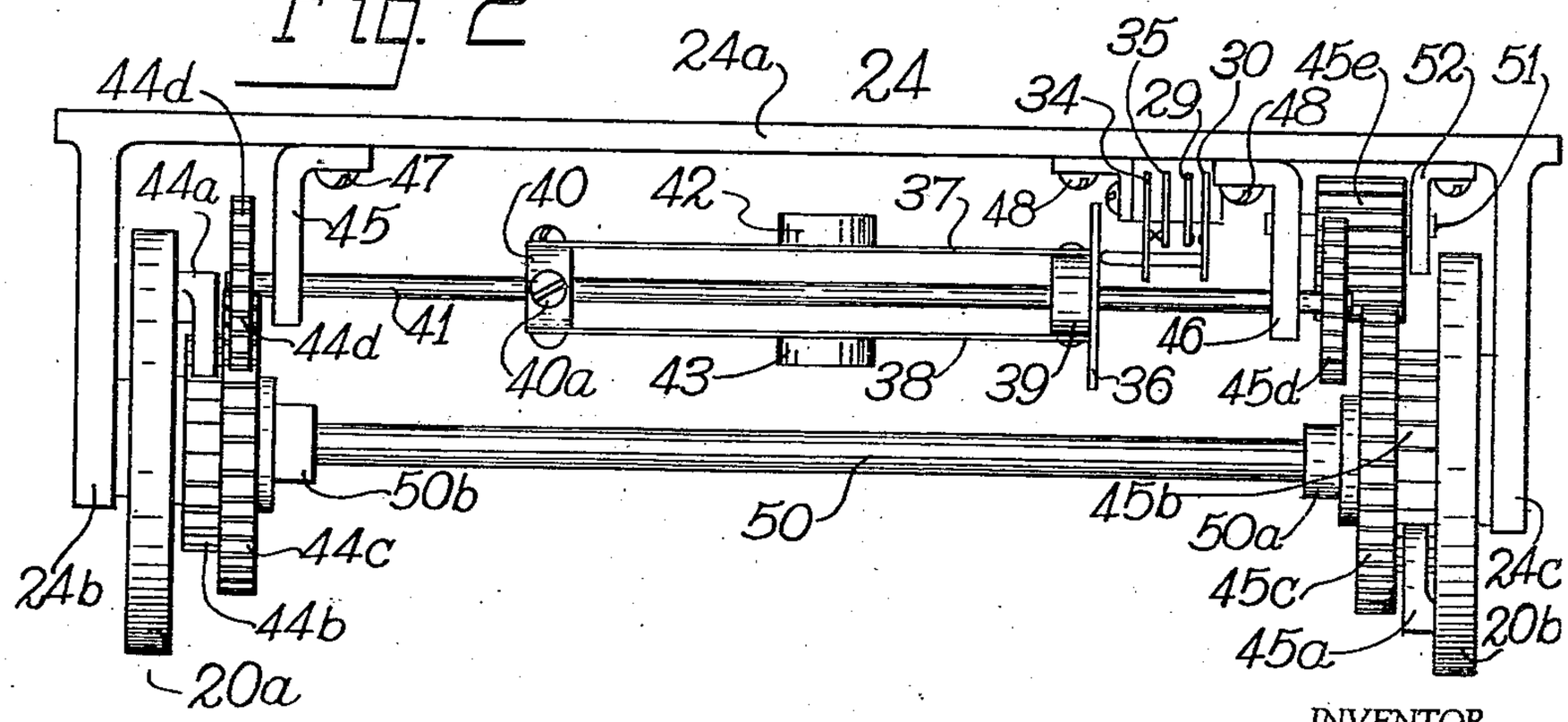

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Fig. 4

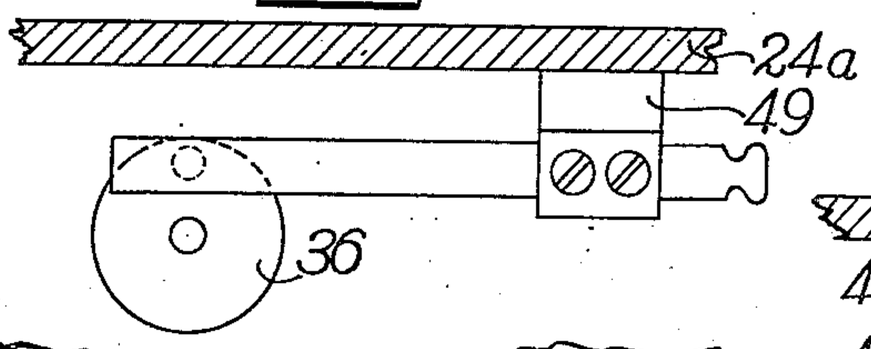
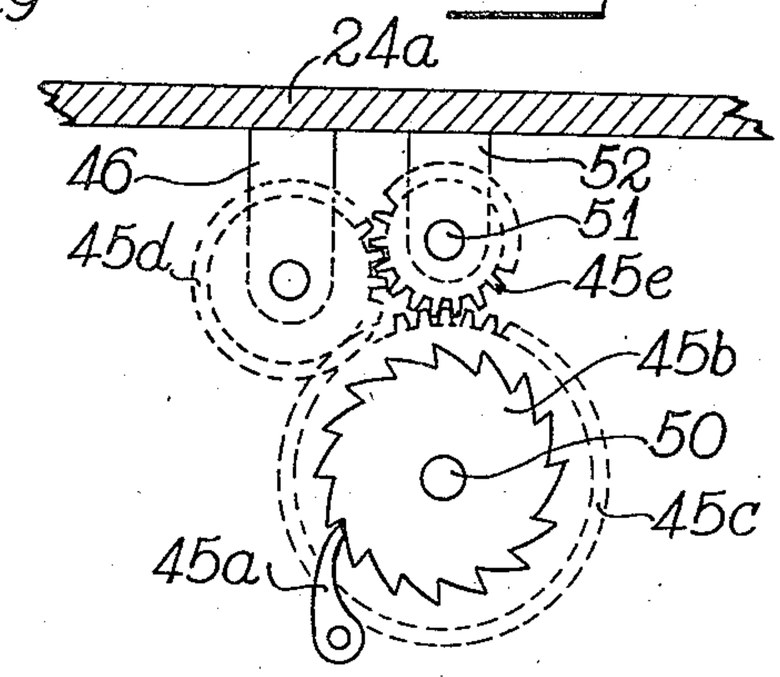


Fig. 3



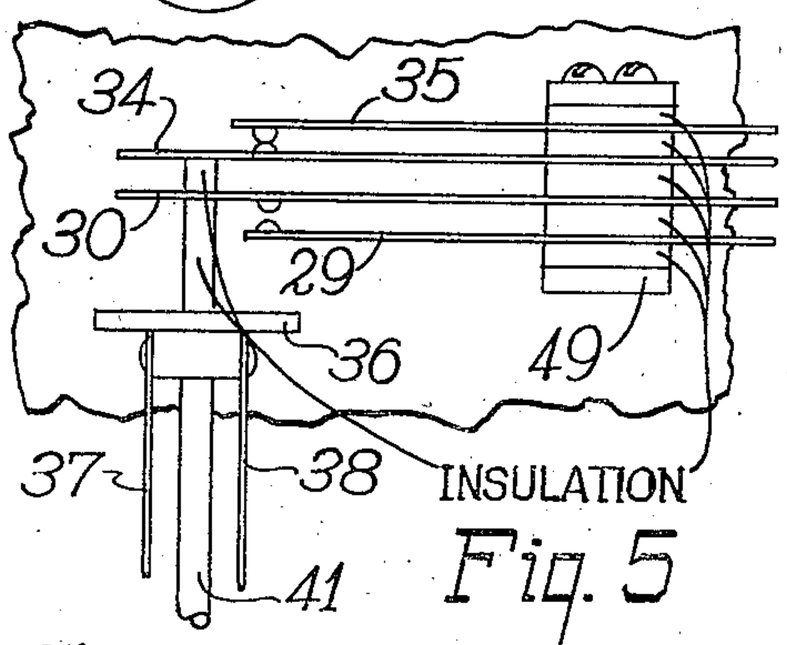


Fig. 5

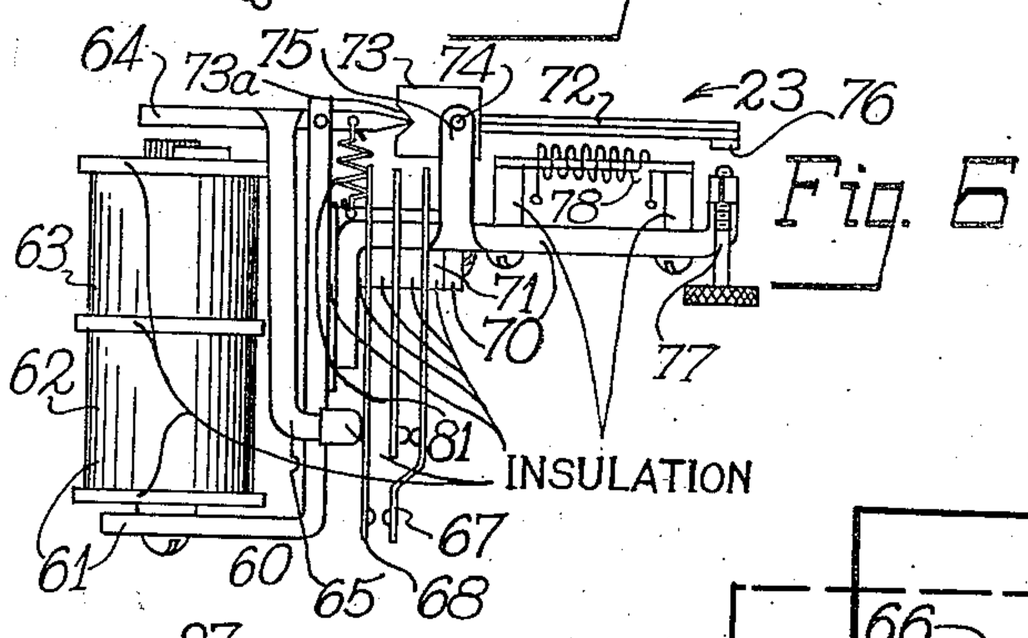


Fig. 6

Fig. 7

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VACUUM CLEANING APPARATUS

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Application October 2, 1941, Serial No. 413,287

20 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. Specifically, the present invention relates to further improvements in a vacuum cleaner of the improved form disclosed and claimed in copending application Serial No. 389,287, filed April 19, 1941, by Richard D. Mason and issued July 6, 1943, as Patent 2,323,554.

A cleaner of the general 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. Moreover, the usual household cleaner is always equipped with a manually operable switch for controlling the fan motor. Frequently, however, the operator prefers to pull the cord plug from the commercial current outlet box in use, in order to stop the cleaner, thus leaving the motor switch in its closed circuit position. When, thereafter, the cord plug is inserted in a live outlet, the fan motor immediately restarts with a resulting annoyance to the operator.

It is an object of the present invention, therefore, to provide improved vacuum cleaning apparatus of the general form briefly described above, in which the control of the cleaning action is fully automatic.

It is another object of the invention to provide an improved cleaner of the character described, wherein the starting of the cleaner is accomplished in a fully automatic manner without resort to manual switch operations.

It is a 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 automatically 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 automatically starting and stopping the cleaning action and 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 automatically starting and stopping 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 a combined circuit controller and timing device are provided, which elements cooperate automatically to close the operating circuit for the driving motor of the cleaner each time movement of the cleaner over the surface to be cleaned is started, and automatically to interrupt the motor operating circuit 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 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, 4 and 5 illustrate the details of the roller actuated switch forming a part of the cleaner shown in Figs. 1; Fig. 6 illustrates the details of the combined circuit controller and timing device embodied in the cleaner; and Fig. 7 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. The housing member 10 is provided with a rearwardly extending pocket 7 in the nose thereof. A socket for receiving a lamp bulb 8 is mounted within this pocket in any desired manner. The lamp is arranged to be energized when the cleaner is in use and serves to illuminate the surface being cleaned. 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 15*a* in the manner illustrated. The member 15*a* 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 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, 5, 6 and 7 of the drawings, there is illustrated the electric circuit apparatus for controlling the driving motor 15. In general, this apparatus comprises a combined circuit controller or relay and timing device 23, and a roller actuated switch 24. 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 cord conductors 27 and 28. More specifically considered, the device 23 comprises an alternating current relay 60 which comprises a magnetic field structure 61 of conventional arrangement, an operating winding 62, a holding winding 63 and a pivoted armature 64 which is provided with an arm 65 for controlling the contact springs 66, 67 and 68 of a suitable spring pile. The enumerated contact springs are mounted on a bracket piece 70 which extends outwardly from the magnetic field structure 61, and are insulated from the field structure and from each other by means of the insulating pieces 71.

The timing element of the device 23 comprises a bi-metal strip 72 having its base end fixedly mounted upon an insulating block 73 which is pivotally mounted at 74 between two arms 75 which extend vertically from the bracket piece 70. The free end of the bi-metal strip 72 carries a contact 76 which is adapted to be moved away from an associated stationary contact 77 when the strip is flexed under the influence of heat produced by a heating element 78. This heating element may be in the form of resistance wire wound around a mica strip 79 which is mounted on two insulating pillars 80 carried by the bracket piece 70. The stationary contact 77 is in the form of an adjustable screw which is threaded through the outer end of the bracket piece 70 to permit ready adjustment thereof relative to the movable contact 76. As shown in the drawings, the insulating block 73 is provided with a laterally extending V-shaped notch 73*a* which receives the outer knife-edged end of the armature 64. Thus, the position of the free end of the bi-metal strip 72 is in part determined by the position of the armature 64 and in part by the influence of the heating element 78. With the armature 64 restrained in its restored position under the influence of the contact spring 68 and the additional biasing spring 81, the contacts 76 and 77 are disengaged.

The control of the device 23 is effected by the roller actuated centrifugal switch 24, the details of which are best shown in Figs. 2, 3, 4 and 5 of the drawings. Briefly described, this switch comprises a pair of normally disengaged contact springs 29 and 30 which are biased to move into engagement and a pair of 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 20*a* and 20*b*. 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 40*a*. This drive shaft is journaled in bearing brackets 45 and 46 which are mounted upon the switch base 24*a* by means of screws 47 and 48. The under side of the base 24*a* 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 accompanied by engagement of the contact springs 29 and 30.

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 20*b*, in cooperation with the mechanism 45, 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 20*a*, in cooperation with the mechanism 44, is arranged to rotate the shaft 41 in the same direction when the cleaner is moved backward over the surface being cleaned. Briefly described, the drive connection 44 comprises a pawl 44*a* carried by the roller 20*a* and spring biased to engage the teeth of a ratchet wheel 44*b* which is mounted for rotation with a gear 44*c*. This gear meshes with a second spur gear 44*d* mounted on the left end

of the shaft 41. The drive connection 45 similarly comprises a pawl 45*a* carried by the roller 20*b* and spring biased to engage the teeth of a ratchet wheel 45*b* which is mounted for rotation with a gear 45*c*. This gear is arranged to drive a gear 45*d* mounted upon the right end of the drive shaft 41 through an idler gear 45*e*. The gears 44*c* and 45*c* are of the same size and have the same number of teeth. Similarly, the gears 44*d*, 45*d* and 45*e* 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 24*b* and 24*c* of the base 24*a*. The rollers 20*a* and 20*b*, the ratchet wheels 44*b* and 45*b*, and the gears 44*c* and 45*c* are all rotatably mounted on the shaft 50. Collars 50*a* and 50*b* are mounted upon the shaft 50 to restrain the gears 44*c* and 45*c* against lateral movement. The idler gears 45*e* 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 24*a*.

In its normal use, the plug end of the cleaner is inserted in a commercial current outlet and the cleaner is then moved forward and backward across the surface being cleaned. Incident to such movement, and irrespective of its direction, the roller actuated switch 24 functions to disengage the contact springs 34 and 35, and to move the contact springs 29 and 30 into engagement. Thus, as the cleaner is moved forward across a surface being cleaned, such, for example, as the rug 9, rotary movement is imparted to the shaft 41 by the roller 20*b* through the drive connection 45. More specifically, the pawl 45*a* engages one of the teeth of the ratchet wheel 45*b* to lock the roller 20*b* and the gear 45*c* against relative movement, immediately clockwise rotation of the rollers 20*a* and 20*b*, as viewed from the right end of Fig. 2, is started. As the gear 45*c* continues to rotate with the roller 20*b*, clockwise rotation is imparted to the drive shaft 41 through this gear, the idler gear 45*e* and the drive gear 45*d*. Preferably, a relatively high gear ratio between the gear 45*c* and the gears 45*d* and 45*e* is employed, so that the speed of rotation of the drive shaft 41 is considerably above that of the roller 20*b*. 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 pile toward the collar 40. In response to this movement of the friction plate 36, the contact springs 34 and 35 are disengaged and the contact springs 29 and 30 are moved into engagement.

The rotation of the shaft 41 is also imparted to the gear 44*c* and the ratchet wheel 44*b* through the drive gear 44*d*, but the direction of rotation of this ratchet wheel is such that the pawl 44*a* rides over the teeth thereof. Thus, the mechanism is not locked against operation, due to the relative movement between the ratchet wheel 44*b* and its associated driving roller 20*a*, 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 20*a*. Thus, each time counter-clockwise rotation of the roller 20*b* is started, as viewed from the right end of Fig. 2, the pawl 44*a* engages one of the teeth of the ratchet wheel 44*b* to lock the roller 20*a* and the gear 44*c* against relative rotation. The gear 44*c* meshing with the drive gear 44*d* serves to continue the clockwise rotation of the shaft 41. During the continued rotation of this shaft, the gear 45*c* and the ratchet wheel 45*b* continue to be driven in a clockwise direction through the gears 45*d* and 45*e*. The roller 20*b* is at this time revolving in a counter-clockwise direction. During such relative movement between the gear 45*c* and the roller 20*b* the pawl 45*a* rides over the teeth of the ratchet wheel 45*b* 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 20*a* and 20*b* 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 44*a* and 45*a* ride over the teeth of their respective associated ratchet wheels 44*b* and 45*b*. 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 held out of engagement and the contact springs 29 and 30 are held in engagement 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 started to initiate the operation of the switch 24 in the manner just explained, a circuit including the contact springs 66, 67, 29 and 30, and the cord conductors 27 and 28 is completed for energizing the operating winding 62 of the control device 23. At the same time, the contact springs 34 and 35 are disengaged to open a point in the incomplete circuit for energizing the heating element 78. When its operating winding 62 is thus energized, the device 23 attracts its armature 64. Incident to the movement of this armature, the contact springs 68 and 67 are first engaged, the bi-metal strip 72 is then rocked about its pivot point 74 to bring the contacts 76 and 77 into engagement, and finally the contact springs 66 and 67 are disengaged. At the contacts 76 and 77, and the contact springs 68 and 67 a circuit including the bi-metal strip 72 is completed for energizing the holding winding 63 of the device 23, thereby to maintain the armature 64 in its attracted position after the operating winding 62 is deenergized. At the contact springs 67 and 68, the circuit for energizing the heating element 78 is also prepared. At these same contact springs, an obvious circuit is completed for energizing the motor 15 and the lamp 8 in parallel. Thus, the lamp 8 is energized to illuminate the area of the rug being cleaned, and operation of the motor 15 to drive the fan 13 and the brush 18 is initiated. Incident to the disengagement of the contact springs 66 and 67, the circuit for energizing the operating winding 62 of the device 23 is broken, thereby to reduce the current drain on the supply source.

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 open the contact springs 29 and 30, and

to close the contact springs 34 and 35. At the contact springs 29 and 30, a second point is opened in the circuit for energizing the operating winding 62 of the device 23. When the springs 34 and 35 are moved into engagement, a circuit including the engaged contact springs 67 and 68, and the conductors 27 and 28, is completed for energizing the heater 78. Under the influence of the heat produced by the heater 78, the bi-metal strip 72 is flexed upward. Assuming that the movement of the cleaner is not restarted, the contact 76 is moved by the bi-metal strip 72 to disengage the contact 77 a predetermined time interval after the heater 78 is energized. When these contacts are opened, the holding winding 63 is obviously deenergized to permit the release of the armature 64 under the influence of the spring bias afforded by the contact spring 68 and the additional spring 81. In returning to its normal position, this armature closes its contact springs 66 and 67, opens its contact springs 67 and 68, and rocks the bi-metal strip 72 further to separate the contacts 76 and 77. At the contact springs 68 and 67, the circuit for energizing the motor 15 and the lamp 8 in parallel, is interrupted. Thus, the operation of the motor 15 to drive the fan 13 and the brush 18 is arrested a predetermined time interval after movement of the cleaner is stopped. At the contacts 76 and 77, and the contact springs 67 and 68, additional points are opened in the circuit for energizing the holding winding 63 of the device 23. At the contact springs 67 and 68, the circuit for energizing the heating element 78 is also opened. At the contact springs 66 and 67, the circuit for energizing the operating winding 62 of the device 23 is reprepared. Thus, the control circuit is fully restored to normal.

Immediately the heater 78 is deenergized, the bi-metal strip 72 starts to cool so that only a few seconds after the operation of the motor 15 is automatically arrested in the manner just explained, the cleaner may be restarted to cause the reoperation of the control device 23. In this regard it will be apparent that if the operation of the machine is restarted shortly after its operation is automatically arrested, the cooling of the bi-metal strip 72 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 78 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 78 is energized, the switch 24 functions to deenergize the heater so that the bi-metal 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.

From the above explanation it will be apparent that the length of each timing interval may be changed at will by adjusting the stationary contact 77 relative to the movable contact 76. It will also be understood that when the bi-metal strip 72 is flexed to separate the contacts 76 and 77 slightly at the end of a timing period, the armature 64 is immediately released to produce further separation of these contacts. Thus, the device 23 is substantially "trip free" in that the initial separation of the contacts 76 and 77 is augmented by the immediate release of the armature 64. Moreover, the release of the armature 64 to rock the bi-metal strip 72 out of the heating zone of the heating element 78, serves to lessen the effect of the residual heat stored in this element on the strip. Accordingly, the initial return flexure of the bi-metal strip to a shape wherein the contacts 76 and 77 may be moved into engagement under the control of the armature 64, is rapidly completed. If desired, provisions may be made in the circuit shown in Fig. 7 of the drawings for selectively rendering inactive the automatic control facilities described above. In such case the manually operable switch 85 may be provided. This switch, which includes the contact springs 86 to 90, inclusive, and the operating member 91, may be mounted upon the housing member 10, and may be used for maintaining the motor 15 continuously in operation. In certain instances where the cleaner is to be used in conjunction with different types of cleaning attachments, this is desirable. In order to incorporate the switch in the control circuit, the contact spring 86 is connected to the terminal 92; the connection between the terminals 93 and 94 is omitted and these terminals are respectively connected to the contact springs 87 and 88; and the connection between the terminals 95 and 96 is opened and these terminals are respectively connected to the contact springs 89 and 90.

With the circuit modified in the manner just explained and the switch 85 occupying its illustrated normal position, the automatic control facilities are operative in the exact manner described above. As modified, however, the operating and locking circuits for the control device 23 and the circuit for energizing the heating element 78 commonly include the contact springs 87 and 88 instead of the connection between the terminals 93 and 94. The locking circuit for the device 23 also includes the contact springs 89 and 90 instead of the connection between the terminals 95 and 96.

When the operating member 91 of the switch 85 is depressed, the contact spring 87 is moved out of engagement with the spring 88 and into engagement with the contact spring 86, and the contact springs 89 and 90 are disengaged. At the contact springs 87, 88, 89 and 90 the circuits for energizing the heating element 78 and the operating and locking windings of the control device 23 are all opened. Thus, the automatic control facilities are rendered inactive. At the contact springs 86 and 87, an obvious circuit is completed for energizing the motor 15 and the lamp 8 in parallel, thereby to initiate the operation of the cleaning means. This circuit is only opened when the switch 85 is manually restored to normal, at which time the automatic control facilities are again conditioned for operation.

While one embodiment of the invention has been described, it will be understood that various modifications may be made therein, without departing from the true spirit and scope of the invention.

What is claimed is:

1. 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, electric circuit means operative in response to movement of said nozzle over said surface for automatically rendering said motor operative to drive said cleaning means, and means for preventing said last named means from an-

erating so long as said cleaner is standing at rest on said surface.

2. 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, a circuit for energizing said motor, means for holding said circuit open so long as said cleaner is standing at rest on said surface, and circuit control means operative only in response to movement of said nozzle over said surface for completing said circuit.

3. Vacuum cleaning apparatus comprising, in combination, a nozzle adapted for movement over a surface to be cleaned, means for creating a suction within said nozzle, an electric motor for driving said suction creating means, electric circuit means for rendering said motor operative to drive said suction creating means, means for preventing said electric circuit means from operating so long as said apparatus is standing at rest on said surface, and means responsive to movement of said nozzle over said surface for effecting operation of said electric circuit means thereby to render said motor operative to drive said suction creating means.

4. Vacuum cleaning apparatus comprising, in combination, a nozzle adapted for movement over a surface to be cleaned, agitating means mounted within said nozzle, an electric motor for driving said agitating means, electric circuit means for rendering said motor operative to drive said agitating means, means for preventing said electric circuit means from operating so long as said apparatus is standing at rest on said surface, and means responsive to movement of said nozzle over said surface for effecting operation of said electric circuit means, thereby to render said motor operative to drive said agitating means.

5. Vacuum cleaning apparatus comprising, in combination, a nozzle adapted for movement over 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, electric circuit means for rendering said motor operative to drive said agitating means and said suction creating means, means for preventing said electric circuit means from operating so long as said apparatus is standing at rest on said surface, and means responsive to movement of said nozzle over said surface for effecting operation of said electric circuit means, thereby to render said motor operative to drive said agitating means and said suction creating means.

6. 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, a normally open circuit for energizing said motor, a relay operative to complete said circuit, means responsive to movement of said nozzle over said surface for energizing said relay, and a locking circuit for said relay, said locking circuit being completed in response to operation of said relay.

7. In combination with a vacuum cleaner which is movable over a surface to be cleaned and includes cleaning means and an electric motor for driving said cleaning means, electric circuit means operative in response to movement of said cleaner over said surface for automatically rendering said motor operative to drive said cleaning means, and electric circuit means for automatically arresting the operation of said cleaning means when movement of said cleaner over said surface is arrested.

8. In combination with a vacuum cleaner which is movable over a surface to be cleaned and includes cleaning means and an electric motor for driving said cleaning means, a normally open circuit for energizing said motor, means for automatically closing said circuit when movement of said cleaner over said surface is started, means for automatically opening said circuit when movement of said cleaner over said surface is arrested, and means for preventing said last named means from operating during the momentary stoppage of said cleaner which occurs at the end of each stroke of the cleaner over said surface.

9. In combination with a vacuum cleaner which includes means for exerting a cleaning action on a surface to be cleaned and an electric motor for driving said cleaning means, means for automatically conditioning said motor to drive said cleaning means when movement of said cleaner over said surface is started, a timing device, means for conditioning said timing device to measure a predetermined time interval when movement of said cleaner over said surface is arrested, and means controlled by said device for arresting the operation of said cleaning means at the end of the measured time interval.

10. In combination with a vacuum cleaner which includes means for exerting a cleaning action on a surface to be cleaned and an electric motor for driving said cleaning means, means for automatically conditioning said motor to drive said cleaning means when movement of said cleaner over said surface is started, and means including a time delay device for automatically arresting the operation of said cleaning means a predetermined time interval after movement of said cleaner over said surface is arrested.

11. A vacuum cleaner comprising means for exerting a cleaning action on a surface to be cleaned, an electric motor for driving said cleaning means, a normally open circuit for energizing said motor, means for automatically closing said circuit when movement of said cleaner over said surface is started, and means including a time delay device for automatically opening said circuit a predetermined time interval after movement of said cleaner over said surface is arrested.

12. A vacuum cleaner comprising means for exerting a cleaning action on a surface to be cleaned, an electric motor for driving said cleaning means, a normally open circuit for energizing said motor, a centrifugal switch operative in response to movement of said cleaner over said surface, means controlled by said switch for automatically closing said circuit when movement of said cleaner over said surface is started, and means including a time delay device controlled by said switch for opening said circuit a predetermined time interval after movement of said cleaner over said surface is arrested.

13. A vacuum cleaner comprising means for exerting a cleaning action on a surface to be cleaned, an electric motor for driving said cleaning means, a normally open circuit for energizing said motor, a centrifugal switch operative in response to movement of said cleaner over said surface, and means controlled by said switch for automatically closing said circuit when movement of said cleaner over said surface is initiated and for automatically opening said circuit when move-

ment of said cleaner over said surface is arrested.

14. A vacuum cleaner comprising means for exerting a cleaning action on a surface to be cleaned, an electric motor for driving said cleaning means, a normally open circuit for energizing said motor, a relay operative to complete said circuit, operating and locking circuits for said relay, means for automatically closing said operating circuit when movement of said cleaner over said surface is started, said relay being operative to complete its locking circuit and to then open its operating circuit, and means for automatically opening said locking circuit when movement of said cleaner over said surface is arrested.

15. A vacuum cleaner comprising means for exerting a cleaning action on a surface to be cleaned, an electric motor for driving said cleaning means, a normally open circuit for energizing said motor, a relay operative to complete said circuit, operating and locking circuits for said relay, means for automatically closing said operating circuit when movement of said cleaner over said surface is started, said relay being operative to complete its locking circuit and to then open its operating circuit, a timing device including a bi-metal element, a heating element and contacts controlled by said bi-metal element for opening said locking circuit a predetermined time interval after said heating element is energized, a normally open circuit for energizing said heating element, and means for automatically closing said last-named circuit when movement of said cleaner over said surface is arrested.

16. A vacuum cleaner comprising means for exerting a cleaning action on a surface to be cleaned, an electric motor for driving said cleaning means, a normally open circuit for energizing said motor, a relay operative to complete said circuit, operating and locking circuits for said relay, said relay being operative to complete its locking circuit and to then open its operating circuit, a switch operative in response to movement of said cleaner over said surface, and means controlled by said switch for closing said operating circuit when movement of said cleaner over said surface is started and for opening said locking circuit when movement of said cleaner over said surface is arrested.

17. A vacuum cleaner comprising means for exerting a cleaning action on a surface to be cleaned, an electric motor for driving said cleaning means, an electric circuit adapted to be controlled to render said motor operative to drive said cleaning means, means responsive to movement of said cleaner over said surface for controlling said circuit to render said motor operative to drive said cleaning means, means for automatically controlling said circuit to render said motor inoperative to drive said cleaning means when movement of said cleaner over said surface is arrested, and means for preventing said last-named means from operating during the momentary stoppage of said cleaner which occurs at the end of each stroke of the cleaner over said surface.

18. A vacuum cleaner comprising means for exerting a cleaning action on a surface to be cleaned, an electric motor for driving said cleaning means, a normally open circuit for energizing said motor, a relay operative to complete said circuit, operating and locking circuits for said relay, means for automatically closing said operating circuit when movement of said cleaner over said surface is started, said relay being operative to complete its locking circuit and to then open its operating circuit, means for automatically opening said locking circuit when movement of said cleaner over said surface is arrested, and means for preventing said last-named means from operating during the momentary stoppage of said cleaner which occurs at the end of each stroke of the cleaner over said surface.

19. A vacuum cleaner comprising means for exerting a cleaning action on a surface to be cleaned, an electric motor for driving said cleaning means, a normally open circuit for energizing said motor, a relay operative to complete said circuit, operating and locking circuits for said relay, means for automatically closing said operating circuit when movement of said cleaner over said surface is started, said relay being operative to complete its locking circuit and to then open its operating circuit, and means including a time delay device for automatically opening said locking circuit a predetermined time interval after movement of said cleaner over said surface is arrested.

20. In a vacuum cleaner which includes an actuating handle, cleaning means and a motor for driving said cleaning means; the combination which includes electric circuit means operative automatically to render said motor operative to drive said cleaning means in response to manual actuation of said handle to move said cleaner over a surface to be cleaned, and means whereby said electric circuit means is prevented from operating so long as said cleaner is standing at rest on said surface.

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