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(54) Vacuum cleaner control system

(57) The present invention provides a vacuum cleaner control system comprising: a first user-operable control (30) for switching a suction source (14) of said vacuum cleaner between an on condition and an off condition; a second user-operable control (32) for switching a rotatable brush (24) in a floorhead (22) of said vacuum cleaner between an on condition and an off condition; a third user-operable control (34) for switching a filter cleaning mechanism (20) for cleaning a filter (18) of said vacuum cleaner between an on condition and an off condition; a detector (38) for detecting when a handle (12) of said vacuum cleaner is tilted between a substantially vertical, storage position and an angled, use position; and an electronic circuit (40) for receiving input signals from said first, second and third user-operable controls (30, 32, 34) and from said detector (38), said electronic circuit (40) having a first output for switching said suction source on and off, a second output for switching said floorhead brush on and off and a third output for switching said filter cleaning mechanism on and off. In a preferred embodiment, the vacuum cleaner control system further comprises a display (36), and the electronic circuit (40) further comprises an output for driving said display, and said display comprises an input for receiving said output from said electronic circuit.

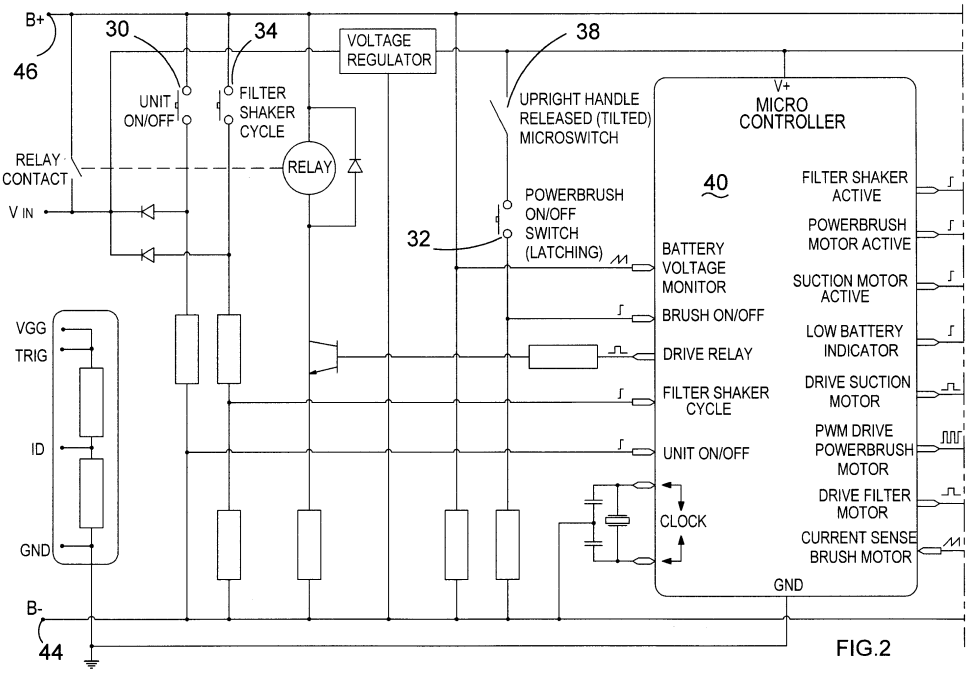

FIG.2

EP 2 113 182 A1

(Cont. next page)

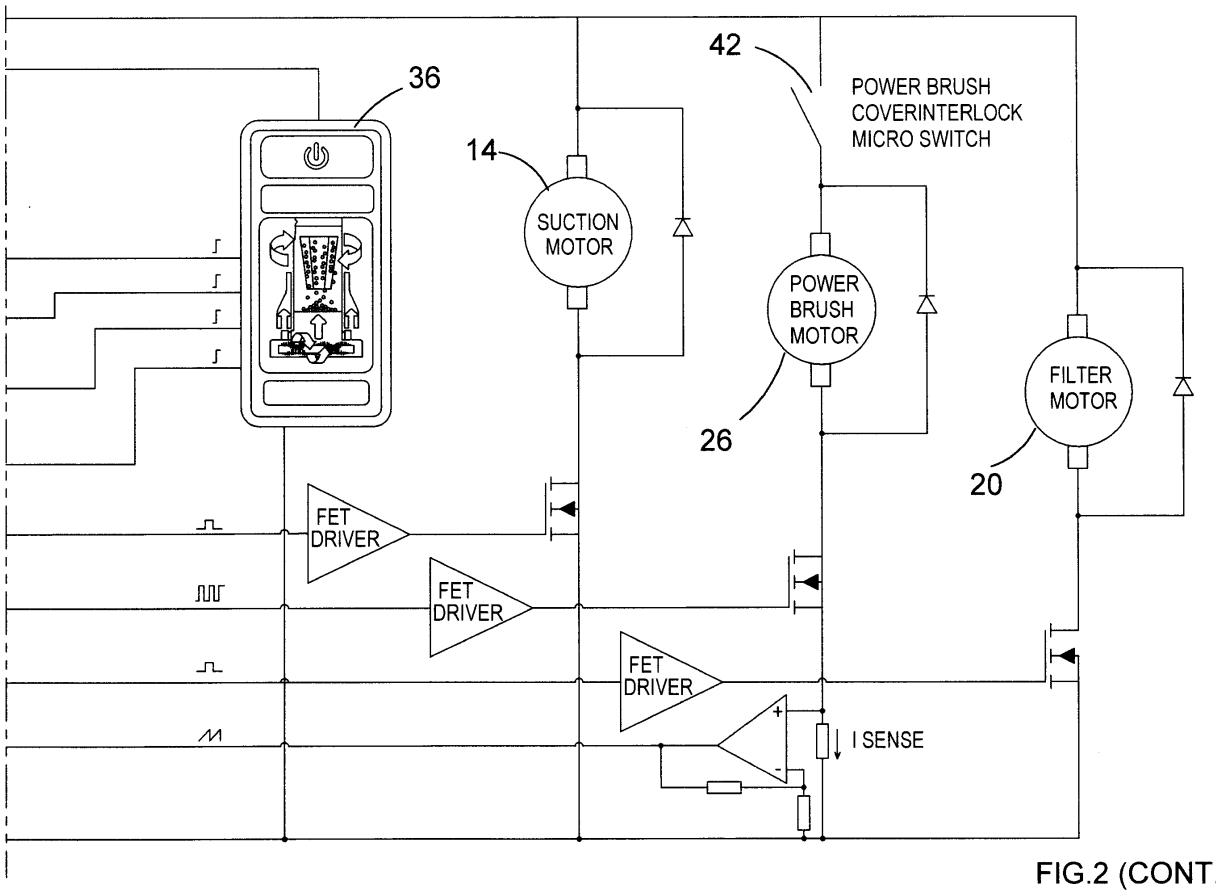
36
14
SUCTION MOTOR
42
POWER BRUSH COVERINTERLOCK MICRO SWITCH
POWER BRUSH MOTOR
26
FILTER MOTOR
20
FET DRIVER
FET DRIVER
FET DRIVER
I SENSE

FIG.2 (CONT.)

Description

[0001] The present invention concerns a control system for a vacuum cleaner. In general, in the known prior art, vacuum cleaner control systems comprise one or more user-operable controls, such as push-button switches, which control the operation of such features of the vacuum cleaner as a main suction source of the vacuum cleaner or a rotatable brush mounted in a floorhead of the vacuum cleaner, independently of each other. On the one hand, this allows a user to select which features of the vacuum cleaner to operate as desired, but on the other, it may also be damaging to the vacuum cleaner, by allowing different features of the vacuum cleaner which have an adverse effect on the vacuum cleaner and/or on each other during their simultaneous operation to be switched on at the same time. This is particularly important in the case of a battery powered vacuum cleaner, where the simultaneous operation of several different unrelated features of the vacuum cleaner may place an undue load on the battery.

[0002] It is therefore desirable to provide an "intelligent" vacuum cleaner control system which is able to address these drawbacks of the known prior art. Accordingly, the present invention provides a vacuum cleaner control system comprising: a first user-operable control for switching a suction source of said vacuum cleaner between an on condition and an off condition; a second user-operable control for switching a rotatable brush in a floorhead of said vacuum cleaner between an on condition and an off condition; a third user-operable control for switching a filter cleaning mechanism for cleaning a filter of said vacuum cleaner between an on condition and an off condition; a detector for detecting when a handle of said vacuum cleaner is tilted between a substantially vertical, storage position and an angled, use position; and an electronic circuit for receiving input signals from said first, second and third user-operable controls and from said detector, said electronic circuit having a first output for switching said suction source on and off, a second output for switching said floorhead brush on and off and a third output for switching said filter cleaning mechanism on and off.

[0003] Thus, by providing the vacuum cleaner control system with such an electronic circuit, the electronic circuit may be programmed to switch different features of the vacuum cleaner on and off to suit the efficient and effective operation of the vacuum cleaner, without permitting the user to perform operations which would tend to damage the vacuum cleaner or its components, or in the case of a battery-powered vacuum cleaner, place undue load on the battery.

[0004] In a preferred embodiment, the vacuum cleaner control system of the present invention further comprises a display, and the electronic circuit further comprises an output for driving said display, and said display comprises an input for receiving said output from said electronic circuit. In this way, even though the user cannot operate all of the various features of the vacuum cleaner completely at will, the user is still made aware of the operations being carried out by the electronic circuit on behalf of the user.

[0005] Preferably, the control system further comprises an interlock switch for detecting when a cover of said floorhead is removed, said interlock switch having an output, wherein said electronic circuit further comprises an input for receiving said output from said interlock switch. Thus, the electronic circuit may be programmed to disable operation of the floorhead brush when the cover of the floorhead is removed, thereby enhancing the safety of the user.

[0006] For greater user convenience, it is also desirable that the first, second and third user-operable controls of the control system should be located on the handle of the vacuum cleaner. If this is not possible because of the overall design of the vacuum cleaner, it is again desirable, but less so, that a majority (i.e. two) of the first, second and third user-operable controls should be located on the handle of the vacuum cleaner. In the event that the control system comprises a display, at least one of the first, second and third user-operable controls should also preferably be integrated into the display for improved user convenience and ergonomics.

[0007] Preferably, when the detector detects that the handle of the vacuum cleaner is in the substantially vertical, storage position, switching on of said floorhead brush by said electronic circuit is disabled. This helps to conserve battery power in the event that the vacuum cleaner is battery-powered, and also ensures that the floorhead brush is not allowed to rotate in a fixed location, which could damage a floor covering, such as a carpet, in that location. This desirable feature of the detector may best be achieved by placing the detector in series with the second user-operable control.

[0008] Further features and advantages of the present invention will be better understood from the following detailed description, which is given by way of example and with reference to the accompanying drawings in which:

Fig. 1 schematically shows a vacuum cleaner comprising a control system according to an embodiment of the invention;

Fig. 2 shows the construction of the control system in the vacuum cleaner of Fig. 1;

Fig. 3 is a flow diagram showing the operation of the vacuum cleaner control system of Fig. 1 in a storage mode thereof;

Fig. 4 is a flow diagram showing the operation of the vacuum cleaner control system of Fig. 1 with a wand of the vacuum cleaner stored and a handle of the vacuum cleaner in a substantially vertical, storage position;

Fig. 5 is a flow diagram showing the operation of the vacuum cleaner control system of Fig. 1 with the wand of the vacuum cleaner stored and the handle of the vacuum cleaner in an angled, use position;

Fig. 6 is a flow diagram showing the operation of the vacuum cleaner control system of Fig. 1 with the wand of the vacuum cleaner removed and the handle of the vacuum cleaner in a substantially vertical, storage position;

Fig. 7 is a flow diagram showing the operation of the vacuum cleaner control system of Fig. 1 with the wand of the vacuum cleaner removed and the handle of the vacuum cleaner in an angled, use position; and

Fig. 8 is a flow diagram showing the operation of the vacuum cleaner control system of Fig. 1 in a filter-cleaning mode thereof.

[0009] Referring firstly to Fig. 1, there is shown a vacuum cleaner 10 comprising a control system according to a preferred embodiment of the invention. The vacuum cleaner 10 has a handle 12, a suction source 14 comprising a primary motor and a fan, a dust collection chamber 16 containing a filter assembly 18, a secondary motor 20 for operating a filter cleaning mechanism for cleaning the filter assembly 18, a floorhead 22 comprising a rotatable brush 24 driven by a third motor 26, and a removable and rechargeable battery pack 28 for supplying power to the vacuum cleaner. The vacuum cleaner also comprises a removable wand 29 which can be used for cleaning above floor level instead of the floorhead 22. This is possible because when the wand is removed from its storage position on the vacuum cleaner, a changeover valve is switched to divert the flow of air drawn into the vacuum cleaner by the suction source 14 from the floorhead 22 to the mouth of the wand 29. Such automatic changeover valves are well known in vacuum cleaners.

[0010] The vacuum cleaner control system itself comprises a series of first, second and third user-operable controls 30, 32, 34 in the form of push-button switches located on the handle 12 of the vacuum cleaner, a display 36 having the first and second user-operable controls formed integrally therein, a detector 38 in the form of a tilt switch for detecting when the handle 12 of the vacuum cleaner is tilted between a substantially vertical, storage position and an angled, use position, an electronic circuit 40 for receiving input signals from the first, second and third user-operable controls 30, 32, 34 and from the detector 38 and an interlock switch 42 for detecting when a cover of the floorhead 22 is removed. The interlock switch 42 is placed in series with the third motor 26 so that when the interlock switch detects that the cover of the floorhead has been removed by a user, for example to clean the brush 24, the supply of power to the third motor 26 from the battery pack 26 is interrupted and the third motor 26 is unable to cause the brush 24 to rotate. Electrical connections between the various components of the vacuum cleaner control system are represented schematically in Fig. 1 by lines connecting these various components.

[0011] The construction of the vacuum cleaner control system of Fig. 1 and the connections between its various components may be better understood by reference to Fig. 2. This shows how the electronic circuit 40 of the vacuum cleaner control system is in the form of a microcontroller and that in addition to it receiving a clock signal, it also receives input signals from the first, second and third user-operable controls 30, 32, 34 and from the detector 38. As may also be seen from Fig. 2, the detector 38 is placed in series with the second user-operable control 32, such that when the detector 38 detects that the handle 12 of the vacuum cleaner is in a substantially vertical, storage position, switching on of the floorhead brush 24 by the electronic circuit 40 is disabled. However, if the handle 12 is in an angled, use position, switching on of the floorhead brush 24 by the electronic circuit 40 is enabled, and apart from the electronic circuit providing power to the motor 26 for driving floorhead brush 24, operation of the second user-operable control 32 by a user to the on condition also causes the electronic circuit 40 to send an output to the display 36 to display floorhead brush-on indicia. Likewise, when the electronic circuit switches the floorhead brush off again, the electronic circuit also sends an output to the display causing the display to cease displaying floorhead brush-on indicia.

[0012] Finally, the electronic circuit 40 also has an input receiving an output signal from a battery charge level sensor in the form of a voltage bridge across the terminals 44, 46 of the battery pack 28. The voltage bridge is set such that when the output signal therefrom reaches a predetermined level, the electronic circuit 40 sends an output to the display 36 causing the display to display low-battery indicia. Otherwise, the electronic circuit 40 has a first output for switching the suction source 14 on and off, a second output for switching the floorhead brush motor 26 on and off and a third output for switching the motor 20 which drives the filter cleaning mechanism on and off. Further outputs of the electronic circuit 40 send signals to the display 36 in a manner which will be better understood by reference to the following description which is given in association with Figs. 3 to 8.

[0013] Referring firstly to Fig. 3, there is shown a flow diagram of the operation of the vacuum cleaner control system in a storage mode thereof, for example when the vacuum cleaner is put by a user in a cupboard or closet. In this storage mode, operation by a user of the first, second and third user-operable controls 30, 32, 34 to the off condition very simply causes the electronic circuit 40 to switch off the suction source 14, the secondary motor 20, the third motor 26 and the display 36. Turning next to Fig. 4, there is shown a flow diagram of the operation of the vacuum cleaner control system when a user takes the vacuum cleaner out of the cupboard or closet ready for use and operates the first user-operable control 30. In this case, operation by the user of the first user-operable control 30 to the on condition causes the electronic circuit 40 to switch the suction source 14 on and to send an output to the display 36 causing the display to display power-on indicia. However, since the handle 12 of the vacuum cleaner is still in the substantially vertical, storage position, detector 38 also relays a signal to electronic

circuit 40 which conveys this fact, with the result that even if the user operates the second user-operable control 32 to the on condition, switching on of the floorhead brush 24 by the electronic circuit 40 is disabled. This helps to conserve battery power when the user has not adjusted the handle 12 of the vacuum cleaner to an angled, use position. Meanwhile, operation by the user of the first user-operable control 30 to the off condition causes the electronic circuit 40 to switch both the suction source 14 and the power-on indicia displayed by the display 36 off again.

[0014] Fig. 5 is a flow diagram showing what happens when the user adjusts the handle 12 of the vacuum cleaner to an angled, use position. In this case, operation by the user of the first user-operable control 30 to the on condition causes the electronic circuit 40 to switch both the suction source 14 and the display 36 on as before. However, since the handle 12 of the vacuum cleaner is now in the angled, use position, detector 38 relays a signal to electronic circuit 40 which conveys this fact, with the result that if the user operates the second user-operable control 32 to the on condition, switching on of the floorhead brush 24 by the electronic circuit 40 is now enabled. Thus, a user may switch the floorhead brush 24 on and off by operating the second user-operable control 32 to the on or off condition respectively, as desired. Meanwhile, operation by the user of the first user-operable control 30 to the off condition causes the electronic circuit 40 to switch both the suction source 14 and the display 36 off again, but also to switch the floorhead brush 24 off again as well.

[0015] Both of Figs. 4 and 5 show what happens when the removable wand 29 is in its storage position on the vacuum cleaner. In contrast, Figs. 6 and 7 show flow diagrams of the operation of the vacuum cleaner control system when the wand is removed from its storage position by a user, for example to perform cleaning above floor level, thereby causing the automatic changeover valve to divert the flow of air drawn into the vacuum cleaner by the suction source 14 from the floorhead 22 to the mouth of the wand 29, as already described above. Figs. 6 and 7 respectively show the operation of the vacuum cleaner control system when the handle 12 is still in the substantially vertical, storage position and when the handle 12 is in the angled, use position, so that Fig. 6 corresponds to Fig. 4 and Fig. 7 corresponds to Fig. 5 in this regard, with the only difference between Fig.6 and Fig. 4 on the one hand and between Fig. 7 and Fig. 5 on the other being the position of the removable wand 29 as just described. However, it will be noted that the operation of the vacuum cleaner shown in Fig. 6 is the same as that shown in Fig. 4 and that the operation of the vacuum cleaner shown in Fig. 7 is also the same as that shown in Fig. 5, even though the wand is in a different position between them. In other words, the position of the wand has no influence or impact on the operation of the vacuum cleaner control system, even though the flow of air through the vacuum cleaner has been diverted from the floorhead 22 to the wand 29 by the automatic changeover valve. This is because the changeover valve does not contain a sensor to relay a signal to the electronic circuit 40 indicating the path of airflow through the vacuum cleaner, and consequently, the electronic circuit 40 receives no such signal on which it can base its control of the vacuum cleaner.

[0016] Finally, Fig. 8 shows a flow diagram of the operation of the vacuum cleaner control system in a filter-cleaning mode thereof, in other words, what happens when a user operates the third user-operable control 34 to an on condition. The operation of the vacuum cleaner control system in this mode depends upon whether or not the suction source 14 is on, in other words, on whether or not a user has previously switched the first user-operable control 30 to the on condition thereof. In the first case that the suction source 14 is in the off condition, the electronic circuit 40 switches the filter cleaning mechanism 20 on for a predetermined period of time, for example for 10 seconds, and then switches the filter cleaning mechanism off again. At the same time, the electronic circuit 40 also sends an output to the display 36 causing it to display filter-cleaning indicia for the period of time that the filter cleaning mechanism is on. As a safety measure, the electronic circuit 40 also continues to cause the display 36 to display filter-cleaning indicia for a short while longer after the filter cleaning mechanism has been switched off again, thereby incorporating a delay before the vacuum cleaner returns to its storage mode in which the suction source 14, the secondary motor 20, the third motor 26 and the display 36 are all switched off. This delay helps to discourage a user from starting up the suction source 14 again whilst the motor 20 of the filter cleaning mechanism is still running down.

[0017] In the second case shown in Fig. 8 that the suction source 14 is already in the on condition, when a user switches the third user-operable control 34 on, the electronic circuit 40 switches the suction source 14 off and also checks whether the third motor 26 driving the floorhead brush 24 is on. If it finds that the third motor 26 is on, the electronic circuit 40 also switches the third motor 26 off before switching the filter cleaning mechanism 20 on for a predetermined period of time, for example for 10 seconds, and then switching the filter cleaning mechanism off again. At the same time, the electronic circuit 40 also sends an output to the display 36 causing it to display filter-cleaning indicia for the period of time that the filter cleaning mechanism is on. In this case, the electronic circuit also restarts the suction source 14 once the filter cleaning operation has been completed by the filter cleaning mechanism at the right time to ensure that the suction source 14 is not starting up again whilst the motor 20 of the filter cleaning mechanism is still running down, and then ceases the display of the filter-cleaning indicia on the display 36 as well. In both of the two alternative cases shown in Fig. 8 and described above, therefore, the operation of the vacuum cleaner control system ensures that there is no flow of air through the filter assembly

18 when the filter cleaning mechanism is operating. This aids the effective operation of the filter cleaning mechanism, as well as reducing the load that would otherwise be placed on the battery pack 28 by operating the motor 20 for driving the filter cleaning mechanism at the same time as operating the suction source 14 and/or the third motor 26.

Claims

1. A vacuum cleaner control system comprising:

a first user-operable control (30) for switching a suction source (14) of said vacuum cleaner between an on condition and an off condition;
a second user-operable control (32) for switching a rotatable brush (24) in a floorhead (22) of said vacuum cleaner between an on condition and an off condition;
a third user-operable control (34) for switching a filter cleaning mechanism (20) for cleaning a filter (18) of said vacuum cleaner between an on condition and an off condition;
a detector (38) for detecting when a handle (12) of said vacuum cleaner is tilted between a substantially vertical, storage position and an angled, use position; and
an electronic circuit (40) for receiving input signals from said first, second and third user-operable controls (30, 32, 34) and from said detector (38), said electronic circuit having a first output for switching said suction source (14) on and off, a second output for switching said floorhead brush (24) on and off and a third output for switching said filter cleaning mechanism (20) on and off.

2. A vacuum cleaner control system according to claim 1, further comprising a display (36), wherein said electronic circuit (40) further comprises an output for driving said display, and said display comprises an input for receiving said output from said electronic circuit.

3. A vacuum cleaner control system according to claim 1 or claim 2, further comprising an interlock switch (42) for detecting when a cover of said floorhead (22) is removed, said interlock switch having an output, wherein said electronic circuit (40) further comprises an input for receiving said output from said interlock switch.

4. A vacuum cleaner control system according to any one of the preceding claims, wherein said first, second and third user-operable controls (30, 32, 34) are located on said handle (12) of said vacuum cleaner.

5. A vacuum cleaner control system according to any one of the preceding claims, wherein when said detector (38) detects that said handle (12) is in said substantially vertical, storage position, switching on of said floorhead brush (24) by said electronic circuit (40) is disabled.

6. A vacuum cleaner control system according to claim 6, wherein said detector (38) is placed in series with said second user-operable control (32).

7. A vacuum cleaner control system according to any one of the preceding claims, wherein when a user switches said first user-operable control (30) on, said electronic circuit (40) switches said suction source (14) on, and wherein when a user switches said first user-operable control off, said electronic circuit switches said suction source off.

8. A vacuum cleaner control system according to any one of claims 2 to 7, wherein when a user switches said first user-operable control (30) on, said electronic circuit (40) sends an output to said display (36) causing said display to display power-on indicia, and wherein when a user switches said first user-operable control off, said electronic circuit sends an output to said display causing said display to cease displaying said power-on indicia.

9. A vacuum cleaner control system according to any one of the preceding claims, wherein when said suction source (14) is off and when a user switches said third user-operable control (34) on, said electronic circuit (40) switches said filter cleaning mechanism (20) on for a predetermined period of time and then switches said filter cleaning mechanism off again.

10. A vacuum cleaner control system according to claim 9 as dependent on claim 2, wherein when said suction source (14) is off and when a user switches said third user-operable control (34) on, said electronic circuit (40) sends an output to said display (36) causing said display to display filter-cleaning indicia for the period of time that said filter cleaning mechanism is on.

11. A vacuum cleaner control system according to any one of claims 7 to 10, wherein when said suction source (14) is on and/or said floorhead brush (24) is on and when a user switches said third user-operable control (34) on, said electronic circuit (40) switches said suction source and/or said floorhead brush off respectively, then switches said filter cleaning mechanism (20) on for the predetermined period of time and then switches said filter cleaning mechanism off again.

12. A vacuum cleaner control system according to claim

11 as dependent on claim 2, wherein when said suction source (14) is on and/or said floorhead brush (24) is on and when a user switches said third user-operable control (34) on, said electronic circuit (40) sends an output to said display (36) causing said display to display filter-cleaning indicia for the period of time that said filter cleaning mechanism is on.

13. A vacuum cleaner control system according to any one of claims 3 to 12, wherein when said interlock switch (42) detects that the cover of said floorhead (22) is removed, switching on of said floorhead brush (24) by said electronic circuit (40) is disabled.

14. A vacuum cleaner control system according to any one of claims 2 to 13, wherein when said electronic circuit (40) switches said floorhead brush (24) on, the electronic circuit also sends an output to said display (36) causing said display to display floorhead brush-on indicia, and wherein when said electronic circuit switches said floorhead brush off, the electronic circuit also sends an output to said display causing said display to cease displaying floorhead brush-on indicia.

15. A vacuum cleaner control system according to any one of claims 2 to 14, wherein said vacuum cleaner is battery powered, said control system further comprises a battery charge level sensor generating an output signal, said electronic circuit (40) comprises an input for receiving the output signal from said charge level sensor, and when said output signal reaches a predetermined level, said electronic circuit sends an output to said display (36) causing said display to display low-battery indicia.

16. A vacuum cleaner control system according to any one of claims 2 to 15, wherein at least one of said first, second and third user-operable controls (30, 32, 34) is integrated into said display (36).

17. A vacuum cleaner control system substantially as hereinbefore described with reference to the accompanying drawings.

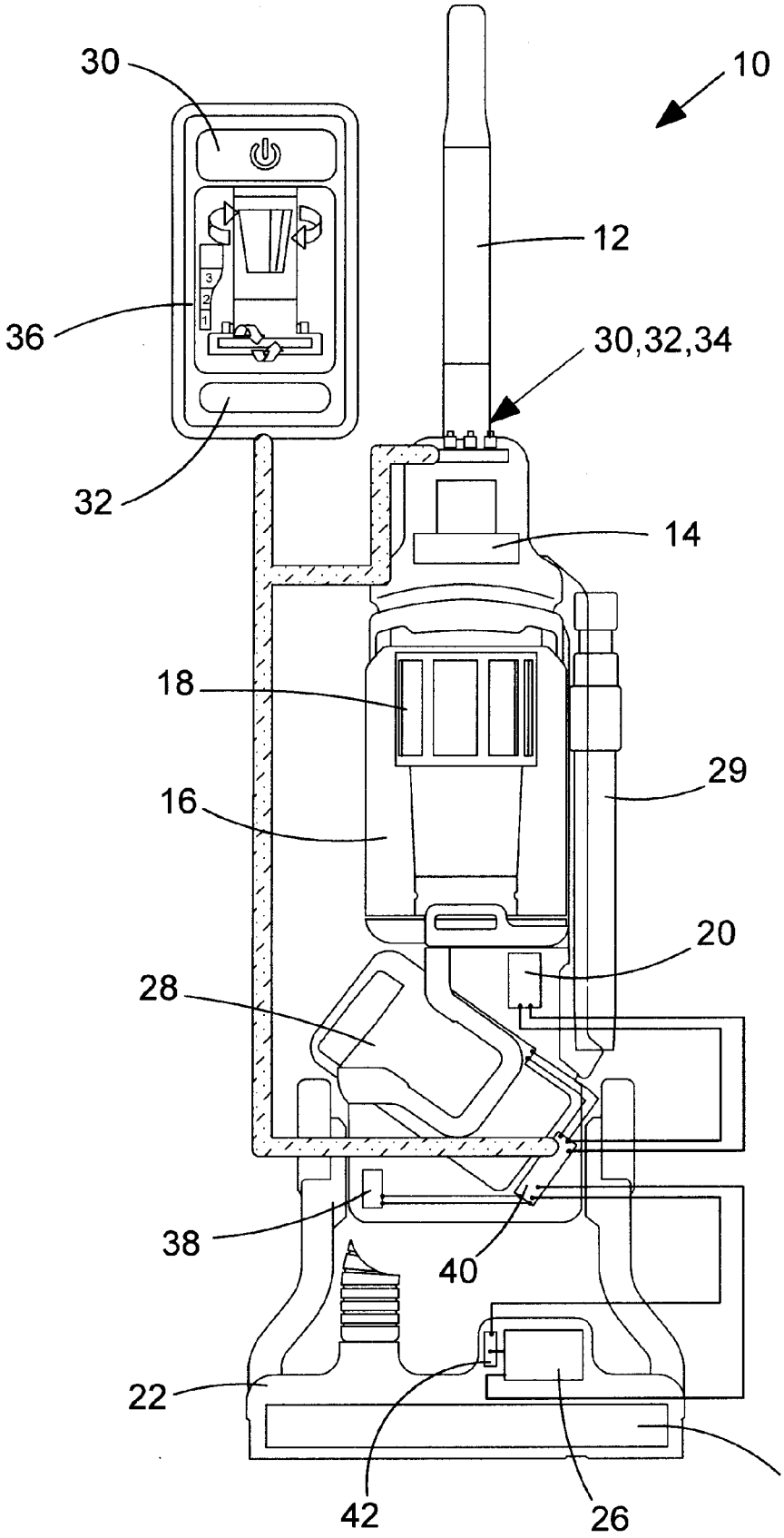

FIG.1

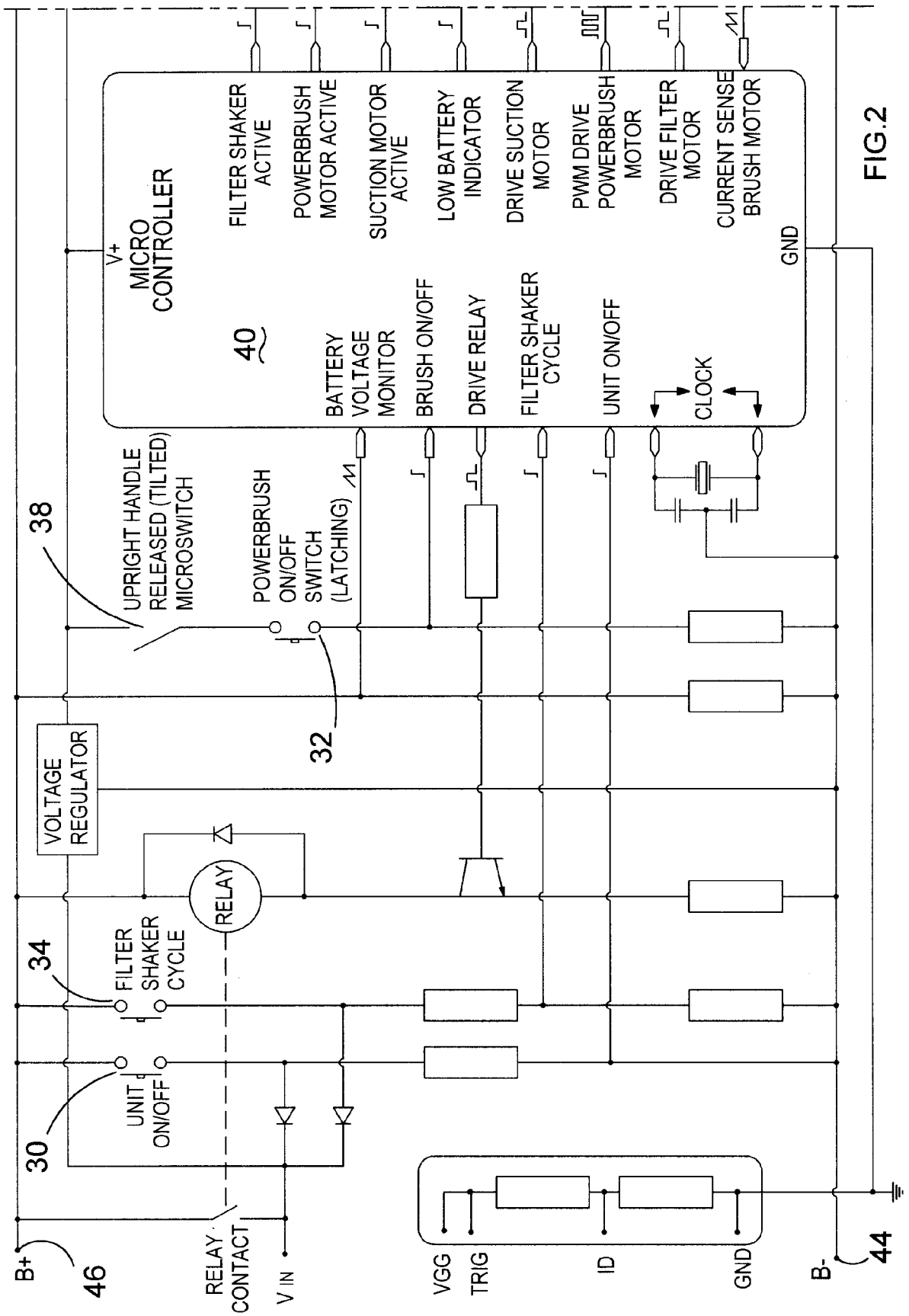
MICRO CONTROLLER
V+
40
FILTER SHAKER ACTIVE
POWERBRUSH MOTOR ACTIVE
SUCTION MOTOR ACTIVE
LOW BATTERY INDICATOR
DRIVE SUCTION MOTOR
PWM DRIVE POWERBRUSH MOTOR
DRIVE FILTER MOTOR
CURRENT SENSE BRUSH MOTOR
GND
BATTERY VOLTAGE MONITOR
BRUSH ON/OFF
DRIVE RELAY
FILTER SHAKER CYCLE
UNIT ON/OFF
CLOCK
UPRIGHT HANDLE RELEASED (TILTED) MICROSWITCH
38
POWERBRUSH ON/OFF SWITCH (LATCHING)
32
VOLTAGE REGULATOR
RELAY
FILTER SHAKER CYCLE
34
UNIT ON/OFF
30
B+
46
RELAY CONTACT
V IN
VGG
TRIG
ID
GND
B-
44

FIG.2

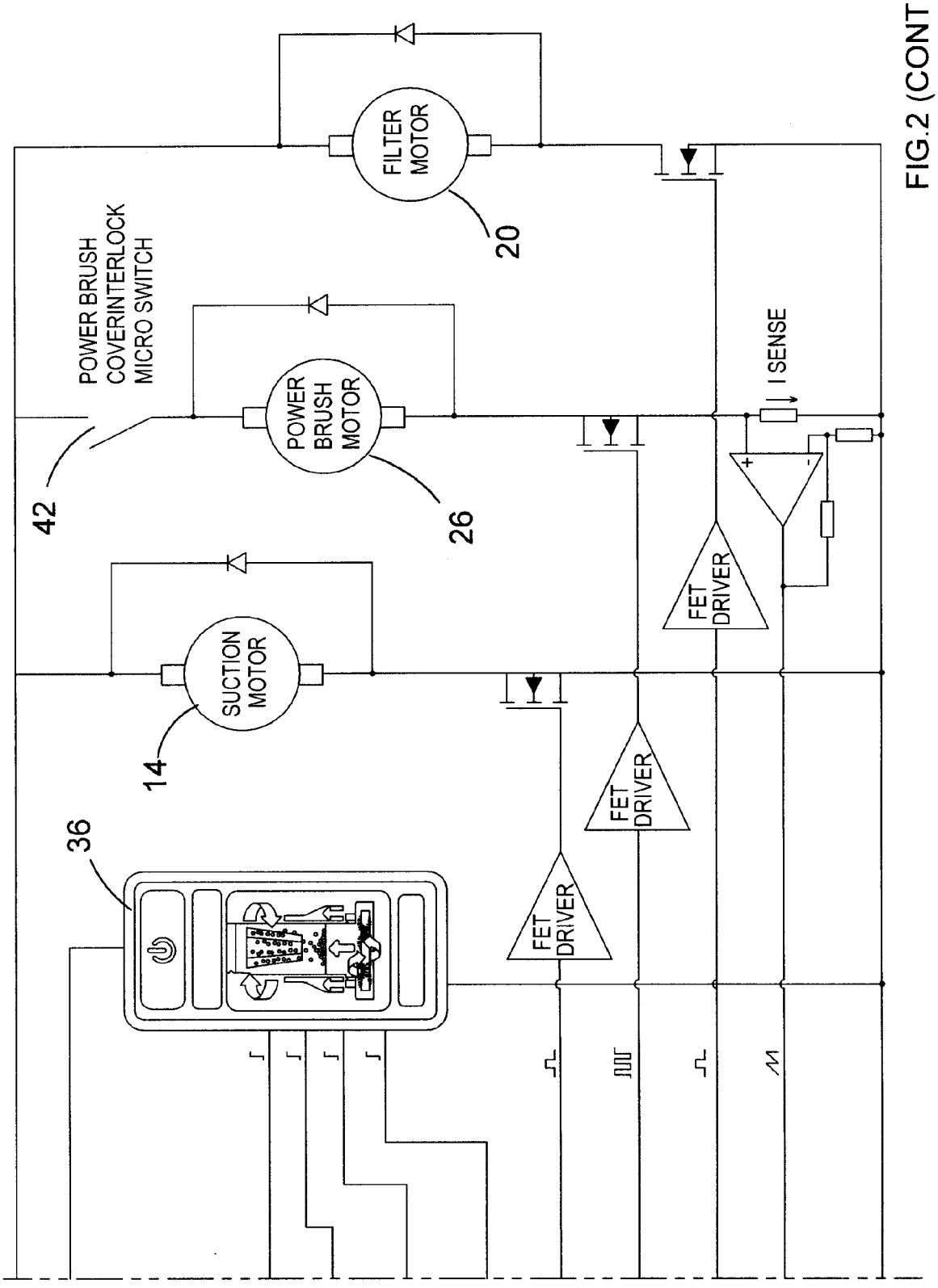
FILTER MOTOR
20
POWER BRUSH COVERINTERLOCK MICRO SWITCH
42
POWER BRUSH MOTOR
26
I SENSE
FET DRIVER
SUCTION MOTOR
14
FET DRIVER
36
FET DRIVER

FIG.2 (CONT.)

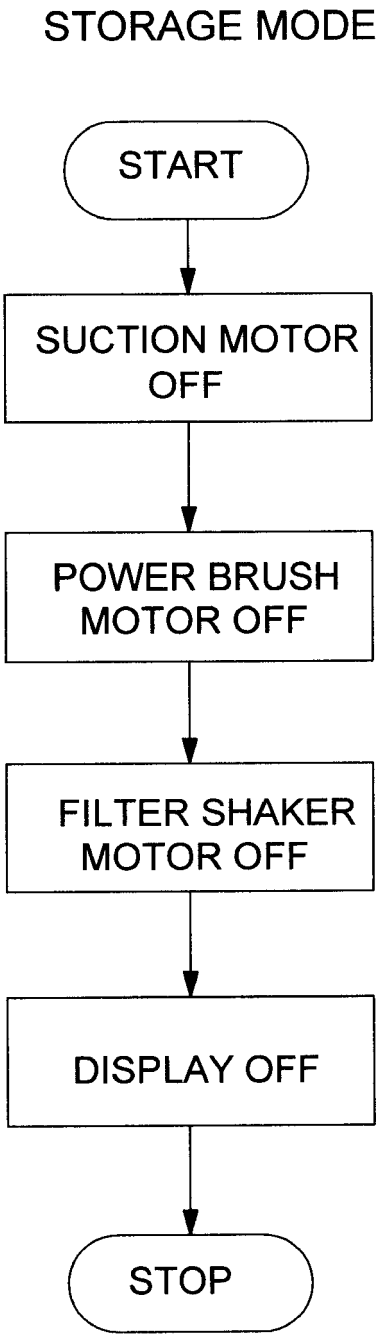
STORAGE MODE
START
SUCTION MOTOR OFF
POWER BRUSH MOTOR OFF
FILTER SHAKER MOTOR OFF
DISPLAY OFF
STOP

FIG.3

UPRIGHT VACUUMING HANDLE NOT RELEASED (NOT TILTED)

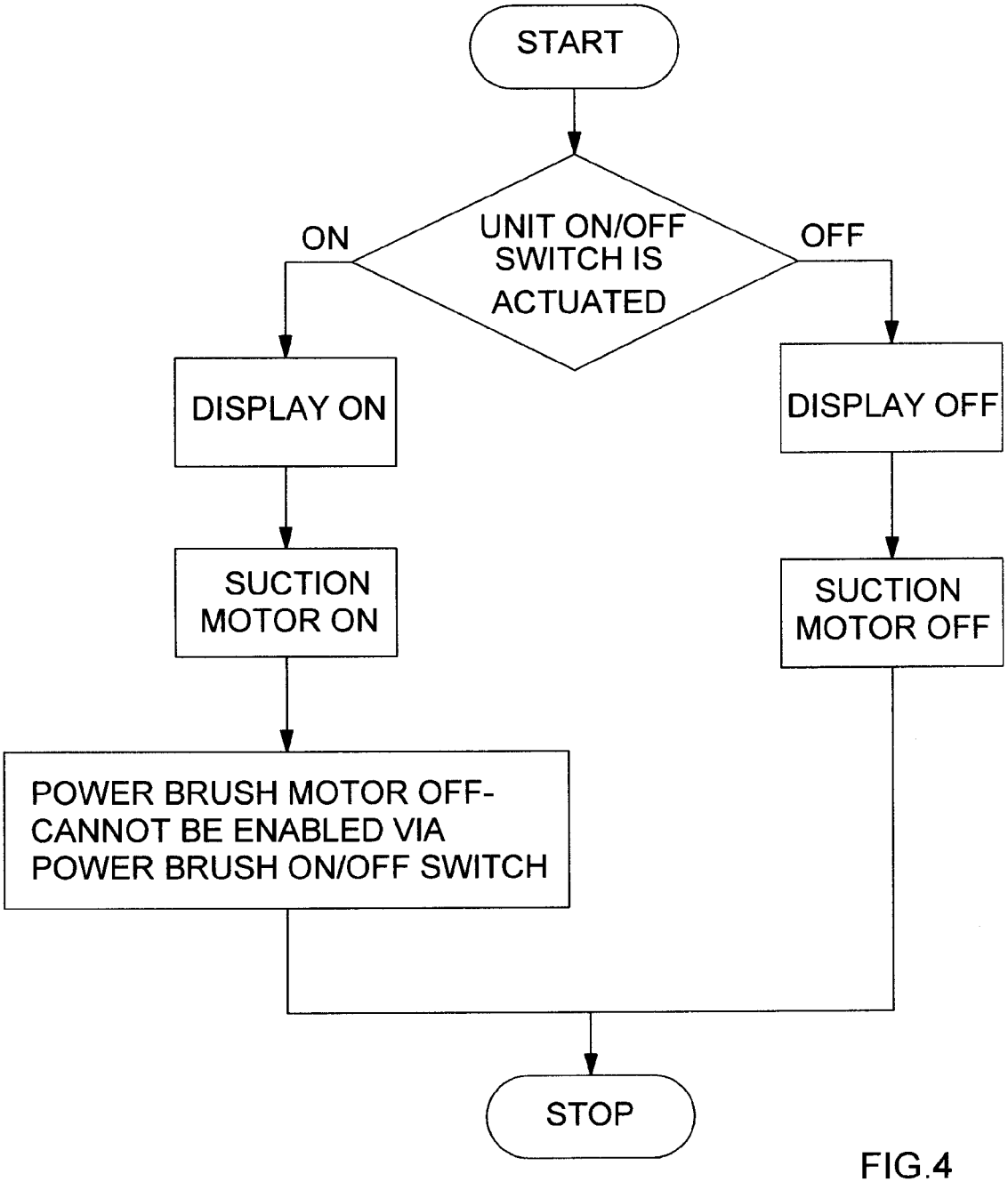

FIG.4

UPRIGHT VACUUMING HANDLE RELEASED
(TILTED)

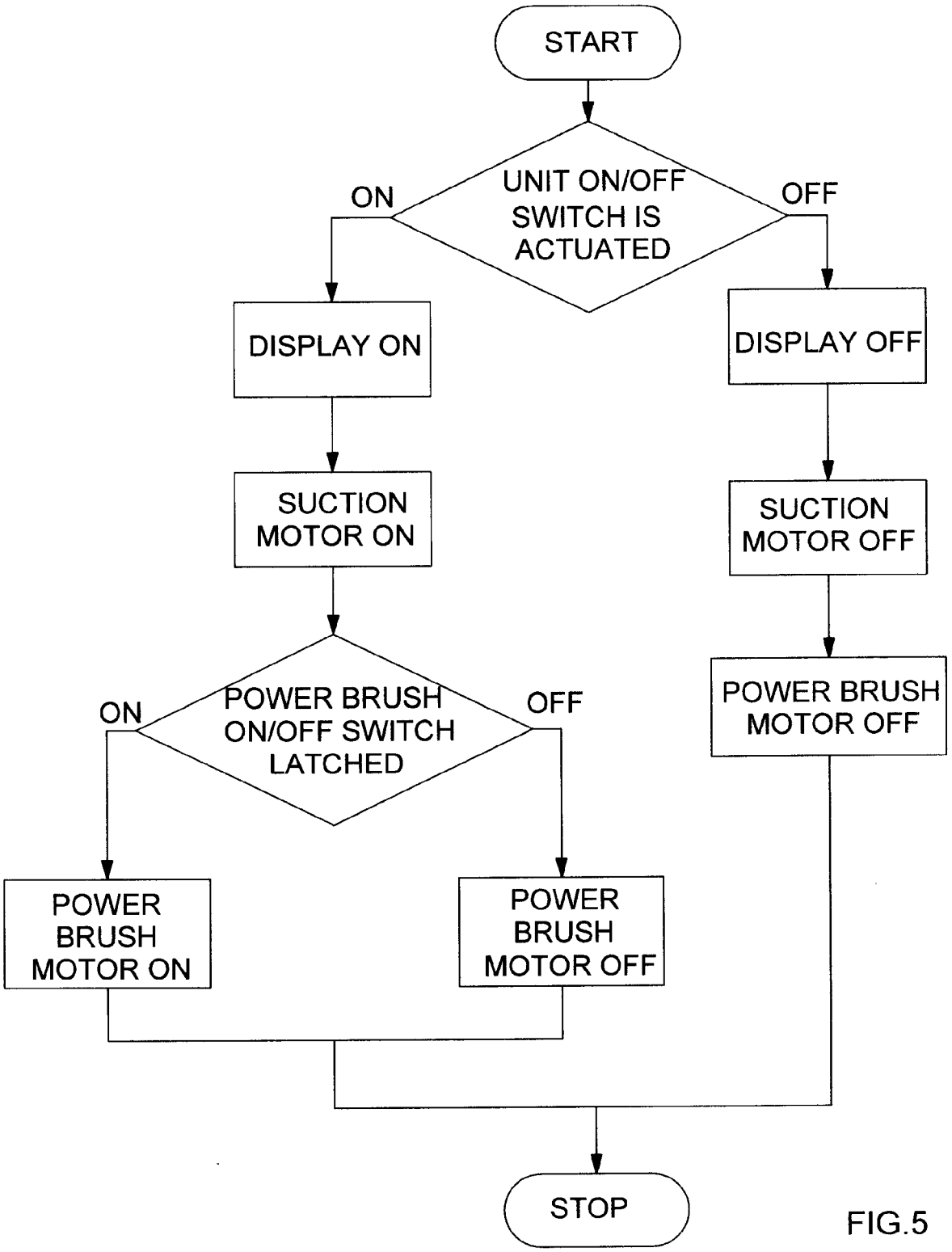

FIG.5

ABOVE FLOOR CLEANING WITH WAND REMOVED
(HANDLE NOT RELEASED - NOT TILTED)

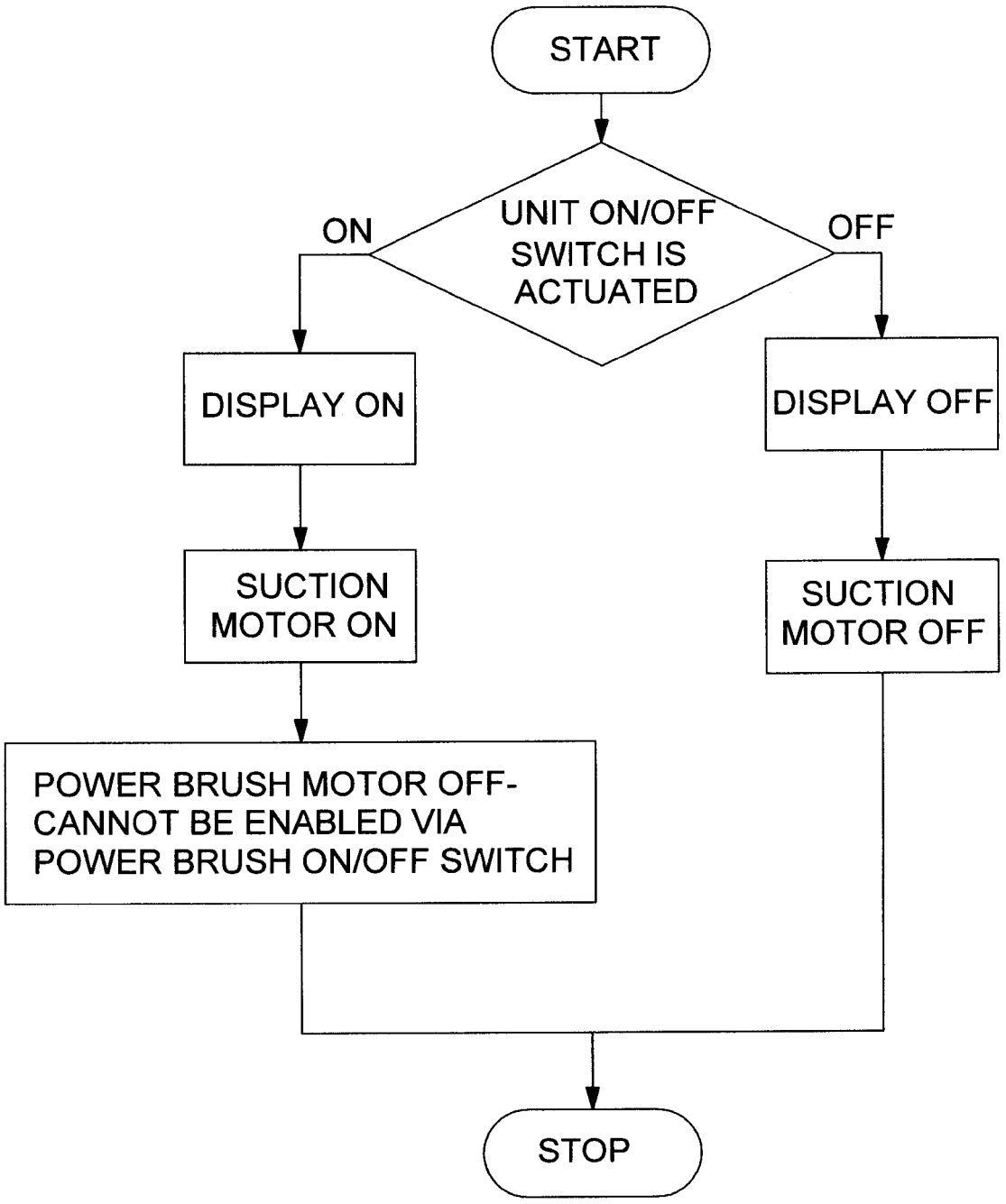

FIG.6

ABOVE FLOOR CLEANING WITH WAND REMOVED
(HANDLE RELEASED - TILTED)

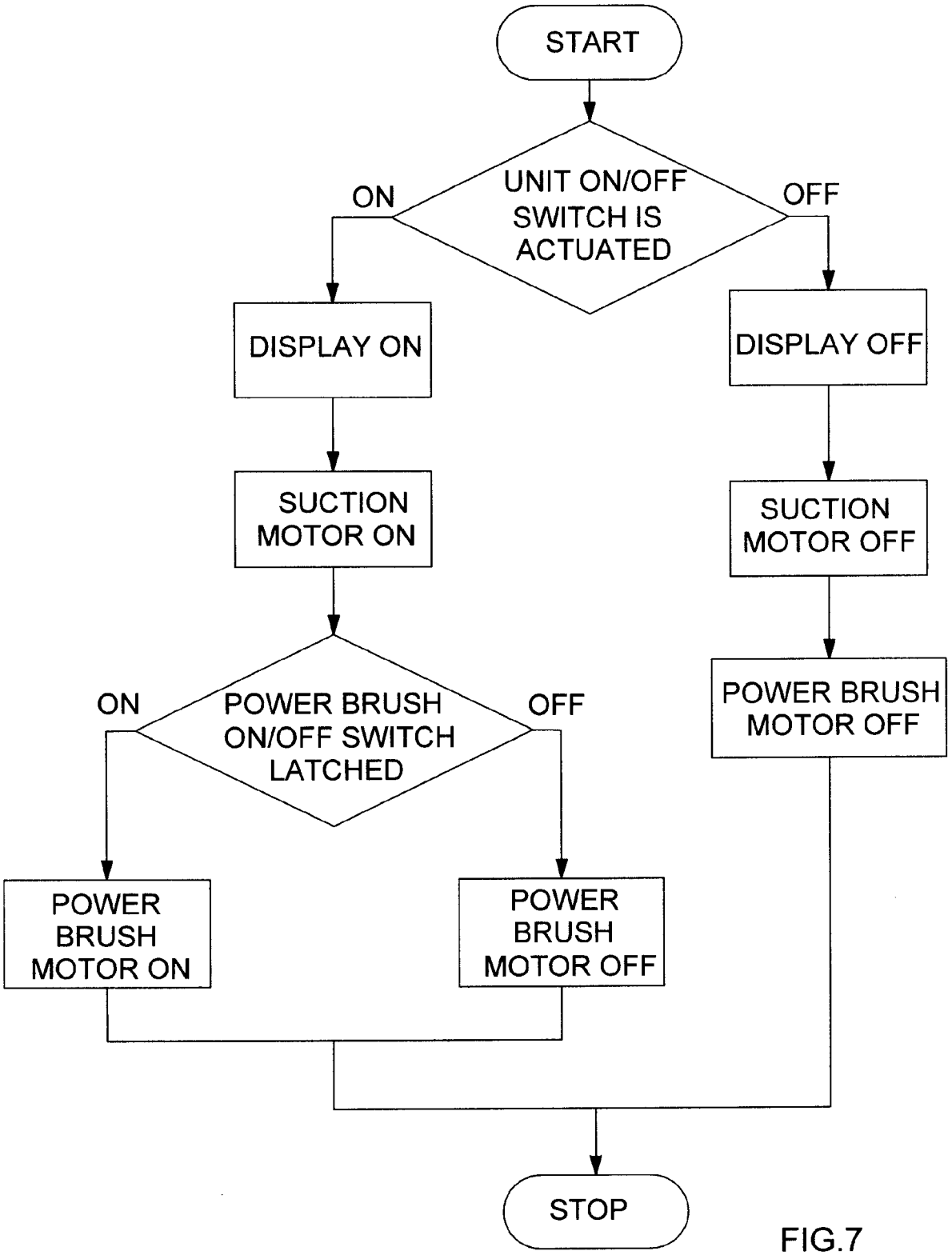

FIG.7

FILTER SHAKER MODE

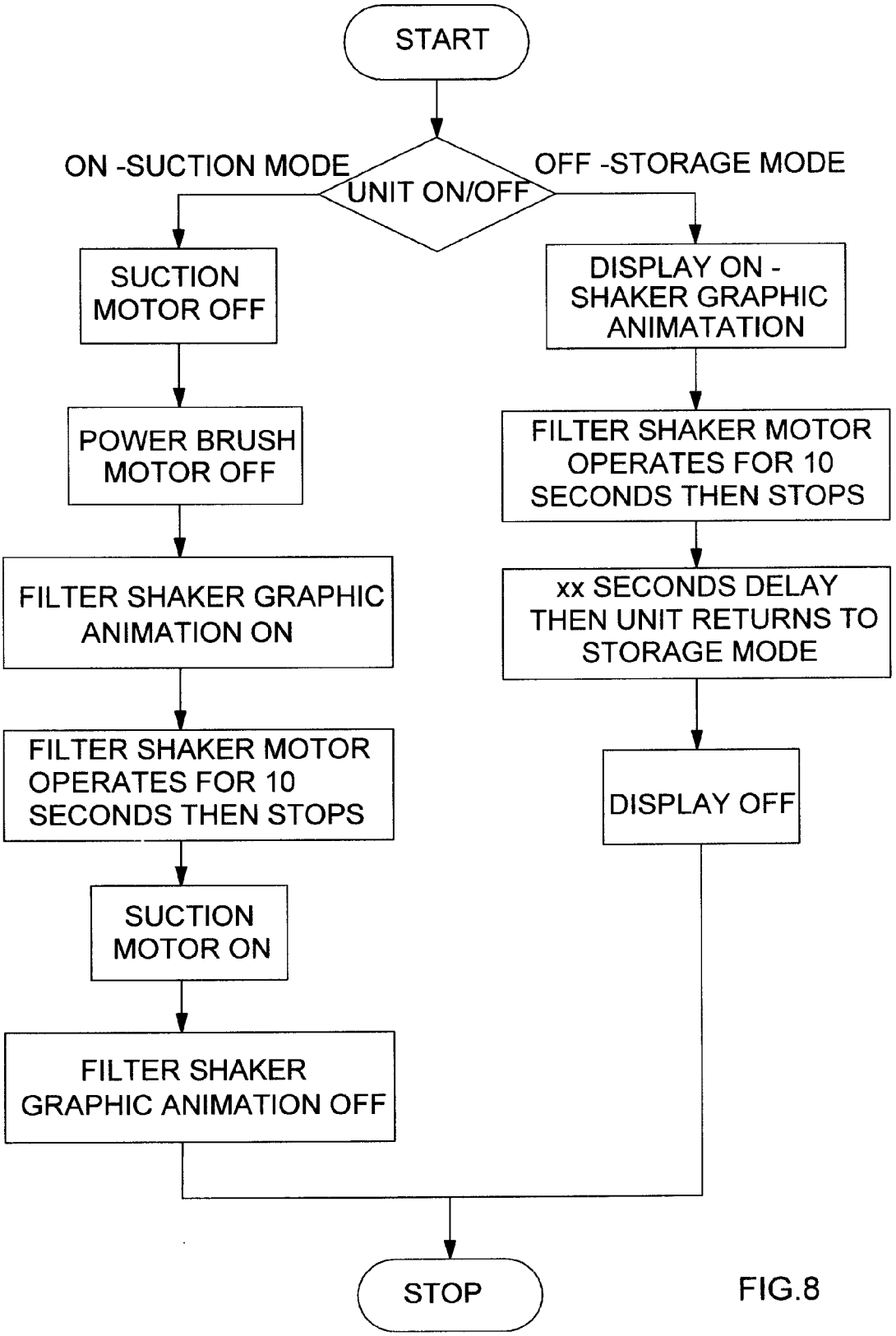

FIG.8

Europäisches Patentamt
European Patent Office
Office européen des brevets

PARTIAL EUROPEAN SEARCH REPORT

Application Number EP 08 15 5592

which under Rule 63 of the European Patent Convention shall be considered, for the purposes of subsequent proceedings, as the European search report

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 2 436 789 A (HOOVER CO [US]) 10 October 2007 (2007-10-10) * page 1, line 5 - page 2, line 20 * * page 4, line 3 - page 5, line 27 * * page 8, line 3 - line 23 * * page 10, line 2 - page 11, line 29 * * page 12, line 24 - page 15, line 24 * * figures 1-15 *	1-16	INV. A47L5/30 A47L9/20 A47L9/28 A47L9/32 A47L9/19
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X	US 2004/144633 A1 (GORDON EVAN A [US] ET AL) 29 July 2004 (2004-07-29) * page 1, left-hand column, paragraph 2 * * page 1, right-hand column, paragraph 7 - paragraph 12 * * page 3, left-hand column, paragraph 30 - page 4, right-hand column, paragraph 36 * * figures 1-9 *	1-16	TECHNICAL FIELDS SEARCHED (IPC) A47L

-/--

INCOMPLETE SEARCH

The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC to such an extent that a meaningful search into the state of the art cannot be carried out, or can only be carried out partially, for these claims.

Claims searched completely :

Claims searched incompletely :

Claims not searched :

Reason for the limitation of the search:

see sheet C

Place of search	Date of completion of the search	Examiner
Munich	6 October 2008	Redelsperger, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04E07)

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PARTIAL EUROPEAN SEARCH REPORT

Application Number
EP 08 15 5592

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A	US 2005/065662 A1 (REINDLE MARK E [US] ET AL) 24 March 2005 (2005-03-24) * the whole document * -----	1-16	TECHNICAL FIELDS SEARCHED (IPC)
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INCOMPLETE SEARCH SHEET C

Application Number
EP 08 15 5592

Claim(s) not searched:
17

Reason for the limitation of the search:

Claim 17 contains references to the drawings. It is unclear which technical features, necessary for the invention, are claimed.
According to Article 84 EPC in combination with the EPC Guidelines C-III,4.17, claims should not contain such references except where absolutely necessary, which is not the case here.
Claim 17 has therefore to be omitted.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 15 5592

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82