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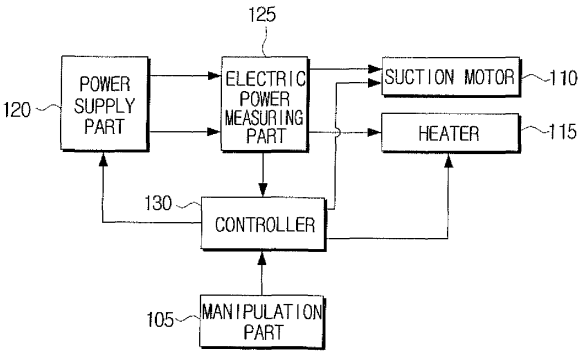
(54) **Steam-vacuum cleaner with electric power controlling function and method thereof**

(57) A steam-vacuum cleaner with an electric power controlling function and a method thereof are provided. The steam-vacuum cleaner includes a suction motor which rotates to generate a suction force; a heater which emits heat to generate a steam; a power supply part which supplies an electric power to the suction motor and the heater; an electric power measuring part which measure a total electric power supplied from the power supplier and consumed in the suction motor and the heater; and a controller which controls at least one of a rotational velocity of the suction motor and a magnitude of heat emitted from the heater such that the total electric power of the suction motor and the heater is maintained less than a threshold value. Accordingly, steam and vacuum cleaning functions are simultaneously performed within the limit of power capacity of a wire.

FIG. 1



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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority from Korean Patent Application No. 10-2007-0054854, filed on June 5, 2007, in the Korean Intellectual Property Office, the entire disclosure of which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] Methods and apparatuses consistent with the present disclosure relate to a steam-vacuum cleaner with an electric power controlling function, which is capable of maintaining a total electric power consumed in the steam-vacuum cleaner less than a threshold value, and a method thereof.

2. Description of the Related Art

[0003] In general, a vacuum cleaner has a body and a brush which are connected with each other via a connection pipe and a hose, and it operates a motor and a filter disposed therein to draw in dust or other foreign substances through the brush connected with the body via the connection pipe and the hose.

[0004] Such a vacuum clear has been currently upgraded so that it can achieve a more complete cleaning operation. That is, besides the function of filtering dust or other foreign substances and then discharging only the drawn-in air to the outside, the vacuum cleaner has a function of removing a stain stuck to a floor surface, a tile surface or a chink in the window using steam or wet-cloth. This upgraded vacuum cleaner is called a steam-vacuum cleaner.

[0005] Such a steam-vacuum cleaner requires an electric power ranging from 500W to 1,500W to vaporize water with a heater. Also, if a vacuum cleaning function is added to the steam-vacuum cleaner, an electric power greater than above is required to drive a suction motor.

[0006] If either one of a steam cleaning function and a vacuum cleaning function is used, the steam-vacuum cleaner can be used regardless of the power capacity of a cord and a wire. However, if both the functions are simultaneously used, the steam-vacuum cleaner requires a double electric power and thus exceeds a limit of the power capacity of the cord and the wire. Also, if the wire is manufactured to be thick in order to meet the increased total electric power, there is another problem that the length of wire becomes shorter in order to be contained in the existing cord reel.

SUMMARY OF THE INVENTION

[0007] Exemplary embodiments of the present disclosure overcome the above disadvantages and other disadvantages not described above. Also, the present disclosure is not required to overcome the disadvantages described above, and an exemplary embodiment of the present disclosure may not overcome any of the problems described above.

[0008] An aspect of the present disclosure provides a steam-vacuum cleaner with an electric power controlling function, which is capable of maintaining a total electric power less than a threshold value in order to make it possible to perform both vacuum-steam and vacuum cleaning operations simultaneously within the limit of capacity of power supplied from a wire, and a method thereof.

[0009] According to an aspect of the present disclosure, there is provided a cleaner, comprising: a suction motor which rotates to generate a suction force; a heater which emits heat to generate a steam; a power supply part which supplies an electric power to the suction motor and the heater; an electric power measuring part which measures a total electric power supplied from the power supplier and consumed in the suction motor and the heater; and a controller which controls at least one of a rotational velocity of the suction motor and a magnitude of heat emitted from the heater such that the total electric power of the suction motor and the heater is maintained less than a threshold value.

[0010] The controller may maintain the magnitude of heat emitted from the heater constant and adjust the rotational velocity of the suction motor, thereby maintaining the total electric power less than the threshold value.

[0011] The controller may control the rotational velocity of the suction motor by means of phase control.

[0012] The controller may maintain the rotational velocity of the suction motor constant and adjust the magnitude of heat emitted from the heater, thereby maintaining the total electric power less than the threshold value.

[0013] The controller may adjust the magnitude of heat emitted from the heater and adjust the rotational velocity of the suction motor, thereby maintaining the total electric power less than the threshold value.

[0014] According to an aspect of the present disclosure, there is provided a method for controlling an electric power, comprising: comparing a total electric power with a threshold value; and if the total electric power exceeds the threshold value, controlling at least one of a rotational velocity of a suction motor and a magnitude of heat emitted from a heater to maintain the total electric power less than the threshold value.

[0015] The controlling step may comprise maintaining the magnitude of heat emitted from the heater constant and adjusting the rotational velocity of the suction motor, thereby maintaining the total electric power less than the threshold value.

[0016] The controlling step may comprise adjusting the rotational velocity of the suction motor by means of phase control.

[0017] The controlling step may comprise maintaining

the rotational velocity of the suction motor constant and adjusting the magnitude of heat emitted from the heater, thereby maintaining the total electric power less than the threshold value.

[0018] The controlling step may comprise adjusting the magnitude of heat emitted from the heater and adjusting the rotational velocity of the suction motor, thereby maintaining the total electric power less than the threshold value.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] Above and other aspects of the present disclosure will become apparent and more readily appreciated from the following description of the exemplary embodiments, taken in conjunction with the accompany drawings of which:

FIG. 1 is a block diagram illustrating a steam-vacuum cleaner according to an exemplary embodiment of the present disclosure;

FIG. 2 is a view illustrating a manipulation part according to an exemplary embodiment of the present disclosure;

FIG. 3 is a flowchart illustrating a method for controlling an electric power of a steam-vacuum cleaner according to an exemplary embodiment of the present disclosure;

FIG. 4 is a flowchart illustrating a method for controlling an electric power of a steam-vacuum cleaner according to another exemplary embodiment of the present disclosure; and

FIG. 5 is a flowchart illustrating a method for controlling an electric power of a steam-vacuum cleaner according to still another exemplary embodiment of the present disclosure.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0020] Certain exemplary embodiments of the present disclosure will be described in greater detail with reference to the accompanying drawings.

[0021] FIG. 1 is a block diagram illustrating a steam-vacuum cleaner according to an exemplary embodiment of the present disclosure. Referring to FIG. 1, the steam-vacuum cleaner comprises a manipulation part 105, a suction motor 110, a heater 115, a power supply part 120, an electric power measuring part 125, and a controller 130.

[0022] The manipulation part 105 is provided with a button or switch which is disposed on one side of a handle located between a hose and a pipe of the steam-vacuum cleaner or disposed on a top of a body, and receives a command from a user and transmits the command to the controller 130, which will be described in detail below. The manipulation part 105 will be described in detail with reference to FIG. 2. FIG. 2 is a view illustrating the manipulation part 105 according to the exemplary embodiment of the present disclosure.

[0023] Referring to FIG. 2, the manipulation part 105 comprises a function switch 105b to select a "vacuum" cleaning function, "vacuum & steam" cleaning function, and "steam" cleaning function of the steam-vacuum cleaner, and a control switch 105a to adjust the degree of vacuum and steam.

[0024] The suction motor 110 is rotated to generate a vacuum in the body of the steam-vacuum cleaner and thus generate a suction force, thereby drawing in dirt or dust. The suction force is adjusted according to a rotational velocity of the suction motor 110, which is controlled by means of phase control. Briefly, the phase control will be described. The phase control, which is one of methods for controlling an electric power, adjusts a conduction angle of an input voltage waveform and thereby controls a supplied electric power. In general the phase control uses a control element called "triac".

[0025] The heater 115 emits heat and thus vaporizes water flowing into the steam-vacuum cleaner. The heater 115 consumes a constant electric power to emit heat and adjusts an amount of vapor according to an amount of water.

[0026] The power supply part 120 receives an external electric power through a cord and a wire provided at one side of the body (not shown) of the steam-vacuum cleaner, and supplies the electric power to the respective elements of the steam-vacuum cleaner. Particularly, the power supply part 120 supplies the electric power to the suction motor 110 and the heater 115 through the electric power measuring part 125.

[0027] The electric power measuring part 125 measures an electric power supplied from the power supply unit 120 to the suction motor 110 and the heater 115 and transmits the result of measuring to the controller 130.

[0028] The controller 130 controls the entire operation of the steam-vacuum cleaner. The controller 130 receives a user's command through the manipulation part 105 and controls at least one of the suction motor 110 and the heater 115 to perform any one of cleaning functions "vacuum", "vacuum & steam", and "steam".

[0029] Particularly, if the suction motor 110 and the heater 115 are simultaneously operated to perform the "vacuum & steam" cleaning function, the controller 130 controls at least one of the suction motor 110 and the heater 115 based on the total electric power which is measured by the electric power measuring part 125, thereby maintaining the total electric power less than a threshold value. The threshold value refers to a maximum electric power which can be input from the outside through the cord and the wire of the steam-vacuum cleaner.

[0030] More specifically, the controller 130 maintains the magnitude of heat emitted from the heater 115 constant and adjusts the rotational velocity of the suction motor 110, thereby maintaining the total electric power less than the threshold value.

[0031] That is, the controller 130 maintains the magnitude of heat emitted from the heater 115 constant and decreases the rotational velocity of the suction motor 110 by means of phase control, thereby decreasing the electric power of the suction motor 110. When the total electric power decreases below the threshold value, the controller 130 stops the phase control of the suction motor 110 and maintains the rotational velocity constant. Accordingly, the total electric power of the steam-vacuum cleaner is maintained less than the threshold value.

[0032] If one of "vacuum" and "steam" cleaning functions is selected, the controller 130 controls one of the suction motor 110 and the heater 115 to be operated according to the selected cleaning function.

[0033] That is, if a "vacuum" cleaning function is selected, the controller 130 controls the suction motor 110 to be operated within the maximum limit of the rotational velocity, without operating the heater 115. The controller 130 intercepts the power supply to the heater 115 and supplies the maximum electric power within the threshold to the suction motor 110, thereby enabling a maximum suction force to be used.

[0034] If a "steam" cleaning function is selected, the controller 130 intercepts the power supply to the suction motor 110 and maintains the magnitude of heat emitted from the heater 115 constant.

[0035] As described above, the total electric power is maintained less than the threshold value by means of phase control of the suction motor 110 if the suction motor 110 and the heater 115 are concurrently operated to perform a "vacuum & steam" cleaning function. Hereinafter, another method to maintain the total electric power less than the threshold value will be described.

[0036] According to another method for maintaining the total electric power less than the threshold value, the controller 130 maintains the rotational velocity of the suction motor 110 constant and adjusts the magnitude of heat emitted from the heater 115, thereby maintaining the total electric power less than the threshold value.

[0037] More specifically, the controller 130 maintains the rotational velocity of the suction motor 110 constant and decreases the magnitude of heat emitted from the heater 115, thereby decreasing the electric power of the heater 115. When the total electric power decreases below the threshold value, the controller 130 controls the magnitude of heat emitted from the heater 115 to be maintained constant. Also, the magnitude of heat emitted from the heater 115 is adjusted within a minimum limit that is required to vaporize the water flowing into the heater 115.

[0038] According to still another method for maintaining the total electric power less than the threshold value, the controller 130 adjusts both the rotational velocity of the suction motor 110 and the magnitude of heat emitted from the heater 115, thereby maintaining the total electric power less than the threshold value.

[0039] More specifically, the controller 130 decreases the rotational velocity of the suction motor 110 by means of the phase control, and also decrease the magnitude of heat emitted from the heater 115, thereby decreasing the electric power of the suction motor 110 and the heater 115. When the electric power decreases below the threshold value, the controller 130 stops the phase control of the suction motor 110 and maintains the rotational velocity and the magnitude of heat emitted from the heater 115 constant. Also, the magnitude of heat emitted from the heater 115 is adjusted within a minimum limit that is required to vaporize the water flowing into the heater 115.

[0040] Hereinafter, a method for maintaining a total electric power less than a threshold value of the steam-vacuum cleaner shown in FIG. 1 will be described. FIG. 3 is a flowchart illustrating a method for controlling an electric power of the steam-vacuum cleaner according to an exemplary embodiment of the present disclosure.

[0041] As shown in FIG. 3, the controller 130 checks a user's command transmitted through the manipulation part 105 (operation S310). That is, the controller 130 checks which one of "vacuum", "vacuum & steam", and "steam" cleaning functions is selected through the function switch 105a.

[0042] If the "vacuum & steam" cleaning function is selected (operation S320-Y), the controller 130 controls the power supply part 120 to supply an electric power to the suction motor 110 and the heater 115 and perform the "vacuum & steam" cleaning function (operation S330).

[0043] The controller 130 determines whether or not the total electric power measured by the electric power measuring part 125 exceeds a threshold value (operation S340). That is, the controller 130 determines whether or not the total electric power supplied to the suction motor 110 and the heater 115 exceeds a threshold value which is a maximum electric power that can be input from the outside through the cord and the wire of the steam-vacuum cleaner.

[0044] If the total electric power exceeds the threshold value (operation S340-Y), the controller 130 maintains the magnitude of heat emitted from the heater constant and controls the rotational velocity of the suction motor 110, thereby maintaining the total electric power less than the threshold value (operation S350). If the total electric power does not exceed the threshold value (operation S340-N), the controller may operate the "vacuum & steam" cleaning function (operation S330) and controller 130 may again determine whether or not the total electric power measured by the electric power measuring part 125 exceeds a threshold value (operation S340).

[0045] More specifically, the controller 130 maintains the magnitude of heat emitted from the heater 115 constant and decreases the rotational velocity of the suction motor 110 by means of phase control, thereby decreasing the electric power of the suction motor 110. Also, when the total electric power decreases below the threshold value, the controller 130 stops the phase control of the suction motor 110 and maintains the rotational velocity constant.

[0046] On the other hand, if the "vacuum" cleaning function is selected (operation S360-Y), the controller 130 controls the suction motor 110 to be operated within a maximum limit of the rotational velocity, without operating the heater 115 (operation S370). That is, the controller 130 intercepts the power supply to the heater 115 and supplies a maximum electric power within the threshold to the suction motor 110, thereby generating a maximum suction force.

[0047] If the "steam" cleaning function is selected (operation S380-Y), the controller 130 operates the heater 115 with the constant magnitude of heat emitted from the heater 115, without rotating the suction motor 110 (operation S390).

[0048] Hereinafter, a method for maintaining a total electric power less than a threshold value in a different way, instead of using the phase control, will be described with reference to FIGS. 4 and 5. FIGS. 4 and 5 are flowcharts illustrating this method when the "vacuum & steam" cleaning function is selected. The same procedure as in FIG. 3 is applied when the "vacuum" or "steam" cleaning function is selected and thus its description will be omitted.

[0049] FIG. 4 is a flowchart illustrating a method for controlling an electric power of a steam-vacuum cleaner according to another embodiment of the present disclosure.

[0050] Referring to FIG. 4, the controller 130 controls the power supply part 120 to supply an electric power to the suction motor 110 and the heater 115 and operates a "vacuum & steam" cleaning function (operation S41 0).

[0051] The controller 130 determines whether or not a total electric power measured by the electric power measuring part 125 exceeds a threshold value (operation S420). That is, the controller 130 determines whether or not the total electric power supplied to the suction motor 110 and the heater 115 exceeds a threshold which is a maximum electric power that can be input from the outside through the cord and the wire of the steam-vacuum cleaner.

[0052] If the total electric power exceeds the threshold (operation S420-Y), the controller 130 maintains the rotational velocity of the suction motor 110 constant and controls the magnitude of heat emitted from the heater 115, thereby maintaining the total electric power less than the threshold value (operation S430). If the total electric power does not exceed the threshold value (operation S420-N), the controller may operate the "vacuum & steam" cleaning function (operation S410) and controller 130 may again determine whether or not the total electric power measured by the electric power measuring part 125 exceeds a threshold value (operation S420).

[0053] More specifically, the controller 130 maintains the rotational velocity of the suction motor 110 constant and decreases the magnitude of heat emitted from the heater 115, thereby decreasing the electric power of the heater 115. When the total electric power decreases below the threshold value, the controller 130 maintains the magnitude of heat emitted from the heater 115 constant. Also, the magnitude of heat is adjusted within a minimum limit that is required to vaporize the water flowing into the heater 115.

[0054] FIG. 5 is a flowchart illustrating a method for controlling an electric power of a steam-vacuum cleaner according to another exemplary embodiment of the present disclosure.

[0055] Referring to FIG. 5, the controller 130 controls the power supply part 120 to supply an electric power to the suction motor 110 and the heater 115 and operates the "vacuum & steam" cleaning function (operation S51 0).

[0056] The controller 130 determines whether or not a total electric power measured by the electric power measuring part 125 exceeds a threshold value (operation S520). That is, the controller 130 determines whether or not the total electric power supplied to the suction motor 110 and the heater 115 exceeds a threshold value which is a maximum electric power that can be input from the outside through the cord and the wire of the steam-vacuum cleaner.

[0057] If the total electric power exceeds the threshold value (operation S520-Y), the controller 130 controls the rotational velocity of the suction motor 110 and the magnitude of heat emitted from the heater 115, thereby maintaining the total electric power less than the threshold value (operation S530). If the total electric power does not exceed the threshold value (operation S520-N), the controller may operate the "vacuum & steam" cleaning function (operation S510) and controller 130 may again determine whether or not the total electric power measured by the electric power measuring part 125 exceeds a threshold value (operation S520).

[0058] More specifically, the controller 130 decreases the rotational velocity of the suction motor 110 by means of phase control, and decreases the magnitude of heat emitted from the heater 115, thereby decreasing the total electric power of the suction motor 110 and the heater 115. When the total electric power decreases below the threshold value, the controller 130 stops the phase control of the suction motor 110 and maintains the rotational velocity and the magnitude of heat emitted from the heater 115 constant. Also, the magnitude of heat emitted from the heater is adjusted within a minimum limit that is required to vaporize the water flowing into the heater 115.

[0059] As described above, the total electric power of the steam-vacuum cleaner is maintained less than a threshold value by controlling the rotational velocity of the suction motor 110 and the magnitude of heat emitted from the heater 115, and thus the steam and vacuum cleaning functions are simultaneously performed within the limit of power capacity available in the wire. Also, when one of the suction motor and the heater is used, the vacuum cleaner takes an advantage of a high output steam jet or high output suction force.

[0060] Although a few exemplary embodiments of the present disclosure have been shown and described, it

will be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the disclosure, the scope of which is defined in the appended claims and their equivalents.

Claims

1. A cleaner, comprising:

a suction motor which rotates to generate a suction force;
a heater which emits heat to generate a steam;
a power supply part which supplies an electric power to the suction motor and the heater;
an electric power measuring part which measures a total electric power consumed in the suction motor and the heater; and
a controller which controls at least one of a rotational velocity of the suction motor and a magnitude of heat emitted from the heater such that the total electric power of the suction motor and the heater is maintained less than a threshold value.

2. The cleaner as claimed in claim 1, wherein the controller maintains the magnitude of heat emitted from the heater constant and adjusts the rotational velocity of the suction motor, thereby maintaining the total electric power less than the threshold value.

3. The cleaner as claimed in claim 1 or 2, wherein the controller controls the rotational velocity of the suction motor by means of phase control.

4. The cleaner as claimed in claim 1, wherein the controller maintains the rotational velocity of the suction motor constant and adjusts the magnitude of heat emitted from the heater, thereby maintaining the total electric power less than the threshold value.

5. The cleaner as claimed in claim 1, wherein the controller adjusts the magnitude of heat emitted from the heater and adjusts the rotational velocity of the suction motor, thereby maintaining the total electric power less than the threshold value.

6. A method for controlling an electric power, comprising the steps of:

- comparing a total electric power with a threshold value; and
- if the total electric power exceeds the threshold value, controlling at least one of a rotational velocity of a suction motor and a magnitude of heat emitted from a heater to maintain the total electric power less than the threshold value.

7. The method as claimed in claim 6, wherein the controlling step comprises maintaining the magnitude of heat emitted from the heater constant and adjusting the rotational velocity of the suction motor, thereby maintaining the total electric power less than the threshold value.

8. The method as claimed in claim 6 or 7, wherein the controlling step comprises adjusting the rotational velocity of the suction motor by phase control.

9. The method as claimed in claim 6, wherein the controlling step comprises maintaining the rotational velocity of the suction motor constant and adjusting the magnitude of heat emitted from the heater, thereby maintaining the total electric power less than the threshold value.

10. The method as claimed in claim 6, wherein the controlling step comprises adjusting the magnitude of heat emitted from the heater and adjusting the rotational velocity of the suction motor, thereby maintaining the total electric power less than the threshold value.

FIG. 1

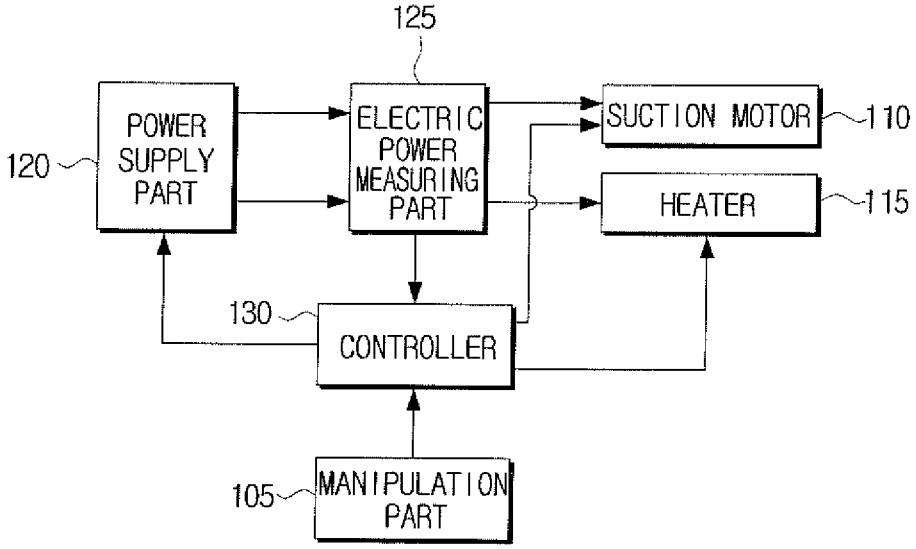

125
POWER SUPPLY PART
120
ELECTRIC POWER MEASURING PART
SUCTION MOTOR
110
HEATER
115
130
CONTROLLER
105
MANIPULATION PART

FIG. 2

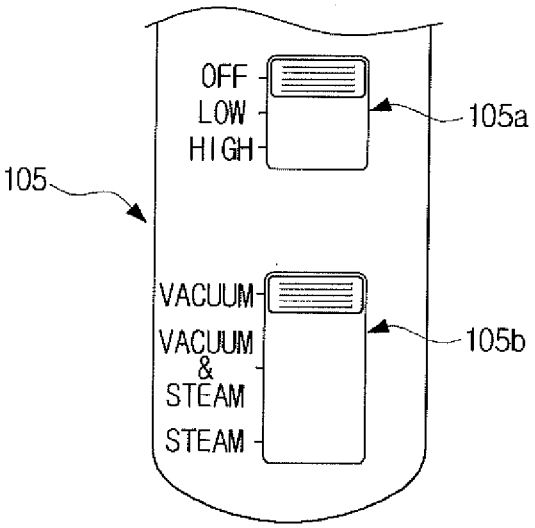

OFF
LOW
HIGH
105a
105
VACUUM
VACUUM & STEAM
STEAM
105b

FIG. 3

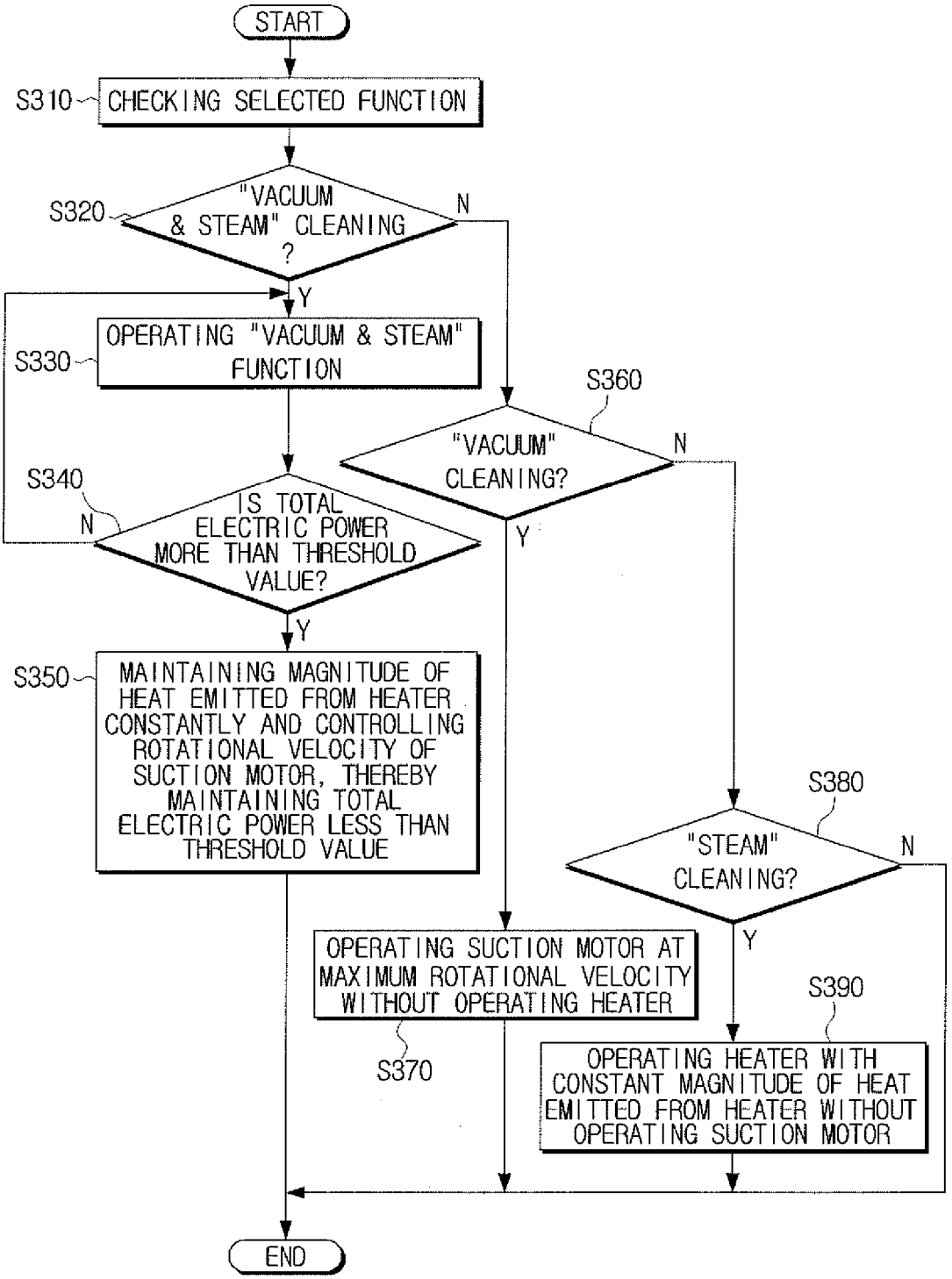

START
S310
CHECKING SELECTED FUNCTION
S320
"VACUUM & STEAM" CLEANING ?
N
Y
S330
OPERATING "VACUUM & STEAM" FUNCTION
S360
"VACUUM" CLEANING?
N
Y
S340
N
IS TOTAL ELECTRIC POWER MORE THAN THRESHOLD VALUE?
Y
S350
MAINTAINING MAGNITUDE OF HEAT EMITTED FROM HEATER CONSTANTLY AND CONTROLLING ROTATIONAL VELOCITY OF SUCTION MOTOR, THEREBY MAINTAINING TOTAL ELECTRIC POWER LESS THAN THRESHOLD VALUE
S380
"STEAM" CLEANING?
N
Y
OPERATING SUCTION MOTOR AT MAXIMUM ROTATIONAL VELOCITY WITHOUT OPERATING HEATER
S370
S390
OPERATING HEATER WITH CONSTANT MAGNITUDE OF HEAT EMITTED FROM HEATER WITHOUT OPERATING SUCTION MOTOR
END

FIG. 4

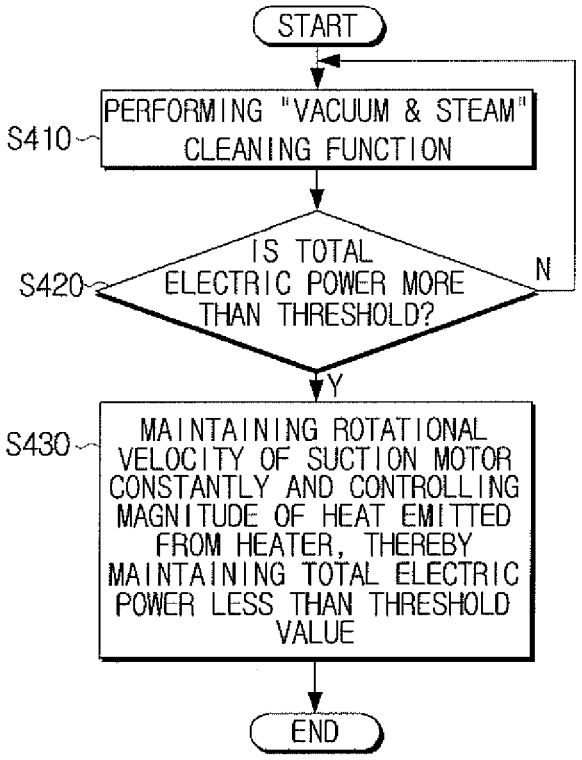
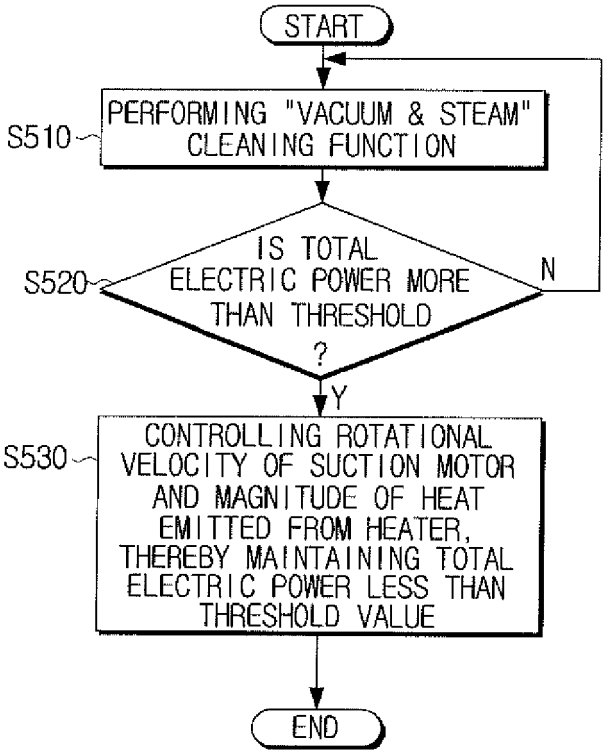

START
S410
PERFORMING "VACUUM & STEAM" CLEANING FUNCTION
S420
IS TOTAL ELECTRIC POWER MORE THAN THRESHOLD?
N
Y
S430
MAINTAINING ROTATIONAL VELOCITY OF SUCTION MOTOR CONSTANTLY AND CONTROLLING MAGNITUDE OF HEAT EMITTED FROM HEATER, THEREBY MAINTAINING TOTAL ELECTRIC POWER LESS THAN THRESHOLD VALUE
END

FIG. 5


START
S510
PERFORMING "VACUUM & STEAM" CLEANING FUNCTION
S520
IS TOTAL ELECTRIC POWER MORE THAN THRESHOLD ?
N
Y
S530
CONTROLLING ROTATIONAL VELOCITY OF SUCTION MOTOR AND MAGNITUDE OF HEAT EMITTED FROM HEATER, THEREBY MAINTAINING TOTAL ELECTRIC POWER LESS THAN THRESHOLD VALUE
END

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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