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(54) **CONTROL METHOD FOR A MOVABLE AIR CONDITIONER EXTRACTING CONDENSED WATER**

(57) A control method for discharging condensed water from a movable air conditioner is provided. No manual operation is necessary to empty the condensed water container. When the condensed water level is higher than a predetermined water level, the conditioner enters into a strong drainage mode operation. Condensing temperature increases and a pump for spraying is activated. The evaporating and draining speed increase as well. Evaporated condensed water will be discharged outdoor as air discharged from the condenser by the exhaust pipe; the rest of the condensed water will flow downward from the condenser to a water tank. When condensed water level bellows the predetermined water level, the conditioner exits the strong drainage mode and enters into a normal operation mode. The heat exchange efficiency of the condenser is also improved by utilizing the condensed water spray circulation system.

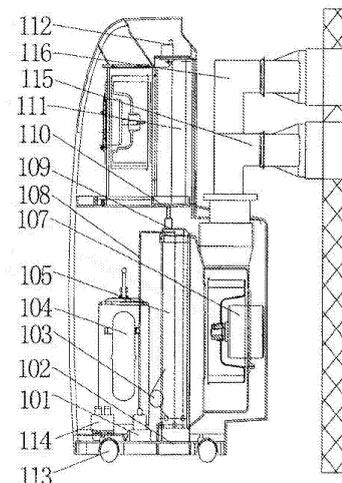


Fig. 1

DescriptionFIELD OF THE INVENTION

[0001] The present invention relates to an air conditioner, particularly relates to a movable air conditioner that is capable of discharging condensed water without manual operation.

[0002] The present invention still relates to a control method for discharging condensed water from a movable air conditioner.

BACKGROUND OF THE INVENTION

[0003] During the cooling operation of a movable air conditioner, if the temperature of the evaporator surface is lower than the room temperature, humidity will be condensed out of the evaporator. There are two major methods used for discharging condensed water from a movable air conditioner in the market: one is directly collecting the condensed water into a water tank. Due to a limited volume, frequently, the water tank has to be emptied manually when it is full so that the water tank can be used again; typically, it takes one to two hours to fill up the water tank in a water condensing condition, it is very inconvenient during night time. Another method is to install a disposal for condensed water, which is generated from the evaporator and directed to the water tank after flowing over the condenser through a spray; the condensed water can then be extracted to the spray by a pump and circulate the spray all over again, some of the condensed water is evaporated on the evaporator and discharged to outdoor by an exhaust pipe. This operation extends the fill up time of a water tank, however, the condensed water is generated faster than the exhaustion rate during water condensing condition, the water tank will eventually be full and require manual operation to empty it; the typical fill up time is two to four hours.

SUMMARY

[0004] It is an object of the present invention to provide a movable air conditioner capable of discharging condensed water without manual operation by adjusting the air flow over condenser. It is to adjust the condensing temperature based on the water volume of the water tank to change the circulating air of the air conditioner condenser; therefore, the condensed water discharge rate is controlled, and the water tank will not be full, manual operation is not necessary.

[0005] It is another object of the present invention to provide a control method for discharging condensed water from the movable air conditioner.

[0006] The air conditioner of the present invention includes a cooling system, a spray system, and a fan system, wherein the cooling system includes a compressor, an evaporator, throttle member, and a condenser that all connected together in a certain order, the spray system

includes a water tank, a pump pumping water from the water tank to the condenser and a water level regulator that controls the operation of the pump, the fan system includes a fan, a motor for adjusting the speed of the fan and a exhaust pipe connected to the condenser; the present invention also employs an electronic control system that controls the blast of the condenser and the operation of the pump.

[0007] When the condensed water of the evaporator flows to the condenser, the cooling efficiency of the condenser is enhanced. Due to high blast temperature of the compressor and the high cooling temperature of the condenser, some of the condensed water is evaporated and discharged outdoors by the exhaust pipe, and the rest will flow into the water tank.

[0008] The control method of discharging condensed water from a movable air conditioner of the present invention includes the followings.

[0009] When the water tank reaches the predetermined water level for spraying, the water level regulator activates the pump to pump water from the water tank to the condenser for circulation.

[0010] When the water tank reaches the predetermined water level for draining, or the water level continues to be higher than the level for spraying for a predetermined amount of time, the water level regulator will signal the electronic control system, which will get into a stage of strong draining mode. That is the electronic control system activating the pump for spray circulation, and lowering the air intake of the condenser, raising the condensing temperature of the cooling system, and therefore raising the evaporation and exhaustion speed of the condensed water.

[0011] Typically, the air intake of the condenser under strong draining mode is about 40% to 80% of the air intake of the normal operation, and the condensing temperature is 5 to 20°C higher than normal operation.

[0012] Usually, it is unable to reach sufficient discharging speed for the condensed water if the increase of condensing temperature is too small, and it will burden the system and wear out the protection and plastic members of the system if the increase of condensing temperature is too big. When the discharging speed of the condensed water is higher than the producing rate, the condensed water will be continuously evaporated and drained outdoor by the exhaust pipe, the water level of the water tank will decrease. When the water level of the water tank is lower than the water level of the spray, the system turns into a normal operation mode. Hence, the water tank of the present invention will not be full, manual operation is not required.

[0013] When the condenser and evaporator use a fan and motor, and a exhaust valve by the electronic control system is set up at the air intake channel of the condenser and the air intake channel of the evaporator, the indoor air after being extracted into the movable air conditioner is divided into two directions, one enters evaporator wind channel and later discharged indoor for cooling after ex-

changing heat with the evaporator, another enters condenser wind channel and later discharged outdoor after exchanging heat with the condenser. Based on the above described condensed water discharging method, the electronic control system controls the exhaust valve to decrease the air intake of the condenser and increase the air intake of the evaporator, and thereby controls the discharge speed of the condensed water. When the movable air conditioner employs a dual shaft motor to drive two independent condenser fan and evaporator fan, the wind channel systems of the condenser and evaporator are independent as well, the electronic control system controls the exhaust valve to decrease the air intake of the condenser and increase the air intake of the evaporator, and thereby controls the discharge speed of the condensed water.

[0014] When the condenser and evaporator use independent fan motor respectively, the condenser fan motor is controlled by the electronic control system, based on the above described condensed water discharging method, the electronic control system raises the condensing temperature by lowering the turning speed of the condenser fan motor so as to control the discharging speed of the condensed water. Typically, the turning speed of the condenser fan motor at the strong drainage mode is 40% ~ 80% of the turning speed at the normal operation mode.

[0015] The condenser is provided under the evaporator; condensed water generated by the evaporator will flow downward to the condenser, and the heat exchange efficiency of the condenser can be improved.

[0016] There is a spray container between the evaporator and the condenser; after the condensed water generated by the evaporator flowing into the spray container, the condensed water is distributed evenly by the spray container, then flows to the condenser. When the pump activates the spraying, the water in the water tank is pumped into the spray container first for even distribution before flowing into the condenser.

[0017] The advantages of the present invention:

1. The movable air conditioner will never have a water full problem due to the control of the discharge speed of the condensed water; no need for manual operation to clear the condensed water.
2. By utilizing the condensed water spray system, the heat exchange efficiency is increased and the operation power is decreased.

DESCRIPTION OF THE DRAWINGS

[0018] The present invention can be further described in details by combining the following attached drawings with the preferred embodiments:

Figure 1 illustrates the structural diagram of the preferred embodiment 1;
Figure 2 illustrates the structural diagram showing

the condensed water discharge system of the present invention;

Figure 3 illustrates the structural diagram showing the condensed water discharge system of the present invention;

Figure 4 illustrates a schematic diagram showing the control principle of the preferred embodiment 1;

Figure 5 illustrates a structural diagram of the preferred embodiment 2; and

Figure 6 illustrates a schematic diagram showing the control principle of the preferred embodiment 2.

DETAILED DESCRIPTION OF THE INVENTION

15 Preferred embodiment 1

[0019] As shown in Figure 1, the present invention is related to a duo wind pipe movable air conditioner with foot wheels 113; a condenser 105 and an evaporator 111 of the movable air conditioner respectively employ an independent fan motor, which is controlled by an electronic control system 112. A compressor 114, the condenser 105, a throttle member 103, and the evaporator 111 connected in order make up the cooling system of the movable air conditioner, supplying chilled air for the system. An electronic control system 112 is an electrical system, which provides safe, efficient, and economical control. A spray container 109, a middle separation board 110, a water tank 102, a pump 101 that pumps water to the condenser 105, a water level regulator 114, and an drainage pipe 108 make up the condensed water spray system.

[0020] The movable air conditioner extracts outdoor air into the condenser 105 by a blast pipe 116, the air is then discharged outdoor by an exhaust pipe 115. As shown in Figures 2-3, condensed water generated by the evaporator 111 flows into the spray container 109 through the middle separation board 110, and flows onto the condenser 105 for evaporation, the evaporated condensed water will be discharged outdoor as air discharged from the condenser 105 by the exhaust pipe 115, the rest of the condensed water will flow downward from the condenser to the water tank 102.

[0021] According to the control method depicted in Figure 4, when the water tank 102 reaches the predetermined water level for spraying, the water level regulator 114 activates the pump 101 to pump condensed water from the water tank 102 to the spray container 109 by the drainage pipe 108 and to the condenser 105 for evaporating circulation, and later discharged outdoor as air discharged from the condenser 105 by the exhaust pipe 115. If the water level of the water tank 102 continues to remain higher than the predetermined water level for spraying (about 10 ~ 20 minutes), the system enters into a strong drainage mode operation. The electronic control system 112 will lower the resolution of the motor 107 to about 60% of the normal operation in order to raise the condensing temperature approximate 10°C while acti-

vating the pump device 101 for spraying, thereby accelerate the evaporating and draining speed. The water level of the water tank 102 decreases little by little, when the water level is lower than the predetermined spray water level, the system exits the strong drainage mode and enters into a normal operation mode; the motor 107 will recover to normal operation.

Preferred embodiment 2:

[0022] As shown in Figure 5, the cooling circulation mechanism is comprised of a compressor 202, a condenser 208, a throttle member 201, and an evaporator 214 to provide cooling for the system, the electronic control system 206 is an electrical system, which operates safely, efficiently, and economically for the movable air conditioner.

[0023] The movable air conditioner condenser 208 and evaporator 214 share a common motor and fan 207, the indoor air after being extracted into the movable air conditioner will be distributed by the exhaust valve 209 and respectively enters a condenser duct 210 and an evaporator duct 212 separated by a partition 218; the indoor air entering into the evaporator duct 212 exchanges heat with the evaporator 214 and is discharged indoor by an exhaust outlet 215 for cooling afterwards, the indoor air entering into the condenser duct 210 exchanges heat with the condenser 208 and is discharged outdoor by the exhaust pipe 213 afterwards.

[0024] The condensed water spray system is comprised of a spray container 211, a water tank 216, a pump device 203, drainage pipe 205, a water level regulator 204 and a water plate 217. The condensed water generated by the evaporator 214 will flow downward to the condenser 208 and evaporate during the flow; the evaporated condensed water will be discharged outdoor as air discharged from the condenser 208 by the exhaust pipe 213. The rest of the condensed water will flow downward from the condenser and be collected by the water plate 217 first then into the water tank 216.

[0025] Referring to the control scheme shown in Figure 6, when the water level of the spray reaches the predetermined water level, the water level regulator 204 will activate the pump device 203 to pump the condensed water of the water tank 216 from the drainage pipe 205 to the spray container 211, and spray the water onto the condenser 208 to circulate for evaporating, and later discharged to the outdoor as air from the condenser 208 by the exhaust pipe 213.

[0026] When the water level of the water tank 216 reaches the predetermined draining water level, the water level regulator 204 will signal the electronic control system 206, and enter the strong drainage mode, the electronic control system 206 will decrease the air intake of the condenser and increase the air intake of the evaporator while activating the pump 203 for circulation spray by controlling the exhaust valve 209, the condenser air intake decrease is about 60% of the normal operation,

thereby the condensing temperature of the condenser 208 increases about 10°C, and the evaporation and discharge speed of the condensed water increase. After the water level of the water tank 216 is under the normal water level, the water level regulator 204 will signal the electronic control system 206, cease the strong drainage mode and enter into a normal operation mode. The water level of the water tank 216 decreases gradually; the system will exist the strong drainage mode and get into the normal operation mode when the water level is lower than the predetermined spray water level, the exhaust valve 209 return to normal open.

15 Claims

1. A movable air conditioner comprises a cooling system, a spray system, a fan system, the cooling system including a compressor, an evaporator, a throttle member and a condenser organized in a certain order; the spray system including a water tank, a pump that pumps water from the water tank to the condenser, and a water level regulator that controls the pump operation; and the fan system including a fan, a motor, and an exhaust pipe connected to the condenser; the movable air conditioner is **characterized in that** an electronic control system is set up for controlling the air intake of the condenser and the pump activation.
2. The movable air conditioner as claimed in claim 1 is **characterized in that** the condenser and the evaporator share a fan motor, and an exhaust valve controlled by the electronic control system is provided at the air intake opening of the condenser wind channel and the air intake opening of the evaporator wind channel.
3. The movable air conditioner as claimed in claim 1 is **characterized in that** the condenser and the evaporator respectively employ independent fan motors, and the condenser fan motor speed is controlled by the electronic control system.
4. The movable air conditioner as claimed in claim 1 or claim 2 or claim 3 is **characterized in that** the condenser is under the evaporator.
5. The movable air conditioner as claimed in claim 4 is **characterized in that** a spray container provided between the condenser and the evaporator.
6. The movable air conditioner as claimed in claim 1, wherein the condensed water discharging method characterizes including

--- when the water level of the water tank reaches the predetermined spray level the, the water lev-

el regulator activates the pump to pump water from the water tank to the condenser for circulation;

--- when the water level of the water tank reaches the predetermined drainage level, or the water level remains higher than the predetermined spray level for a predetermined amount of time, the water level regulator signals the electronic control system, accordingly the air conditioner enters into a strong drainage mode, the electronic control system activates the pump for spraying circulation, and decreases the air intake of the condenser to evaporate or discharge the condensed water.

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- 7. The movable air conditioner as claimed in claim 6, wherein the condensed water discharging method is **characterized in that** under the strong drainage mode, the air intake of the condenser is 40% ~ 80% of the air intake under normal operation, and the condensing temperature is 5 - 20°C higher than normal operation.

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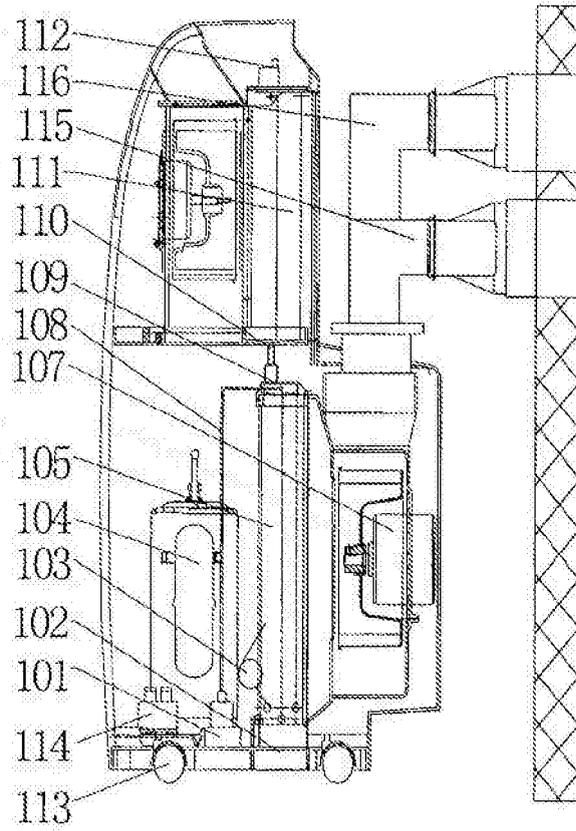


Fig. 1

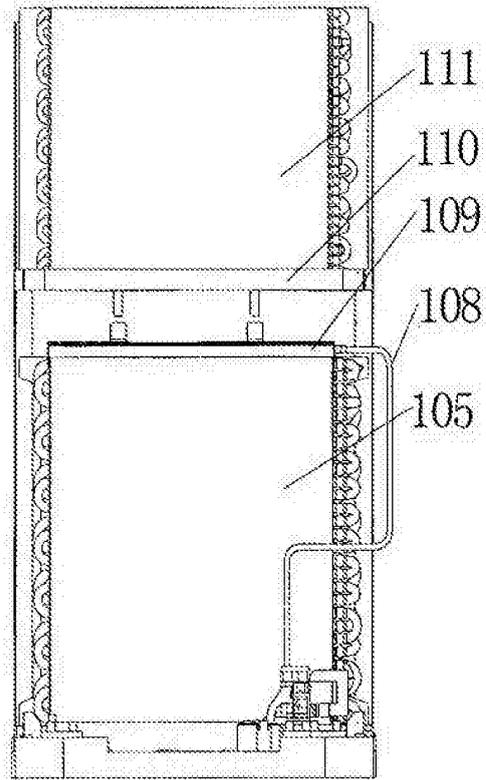


Fig. 2

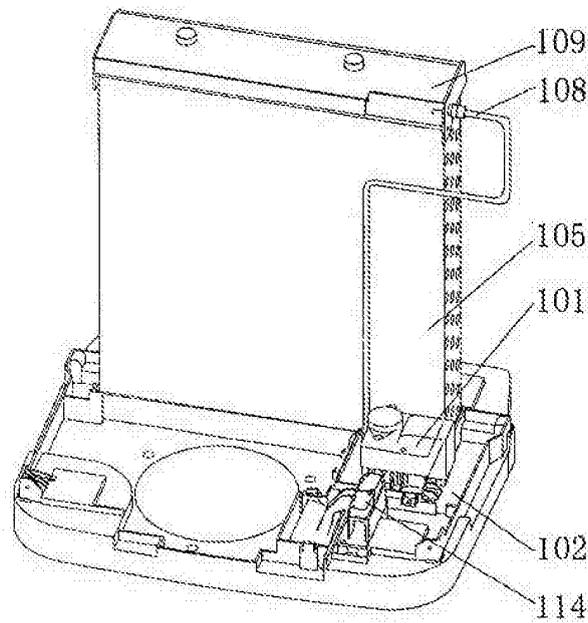


Fig. 3

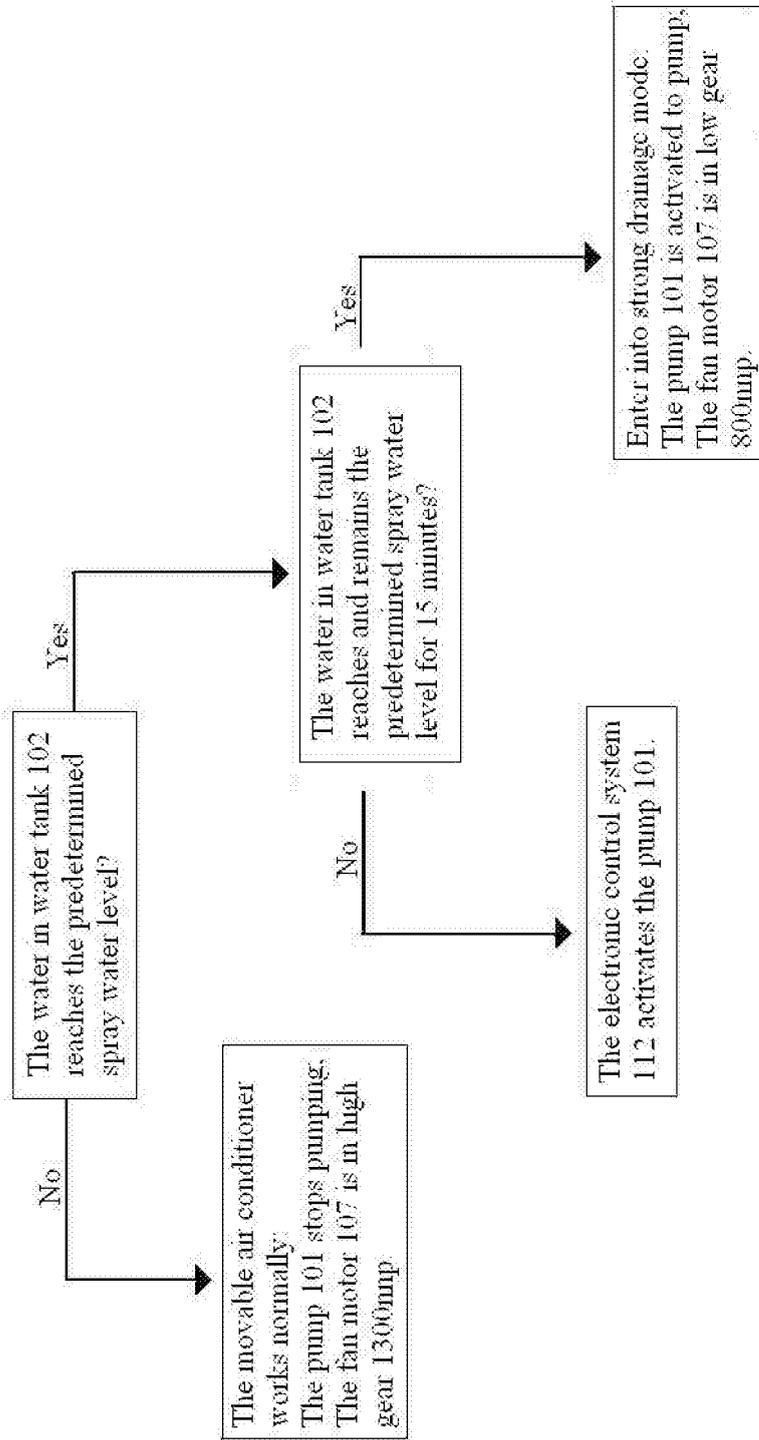


Fig. 4

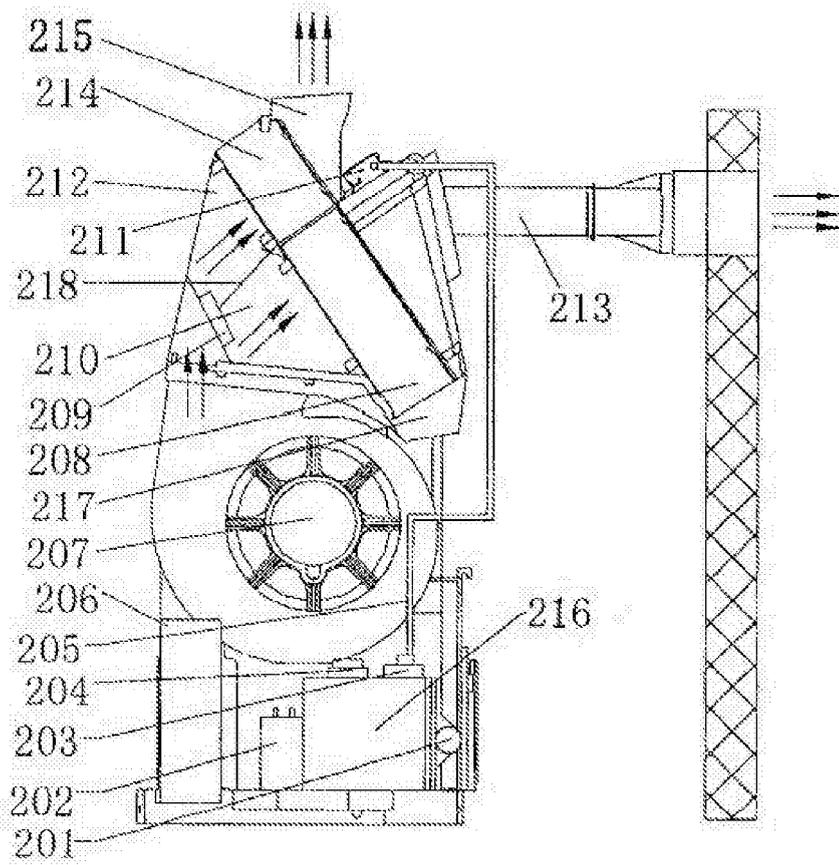


Fig. 5

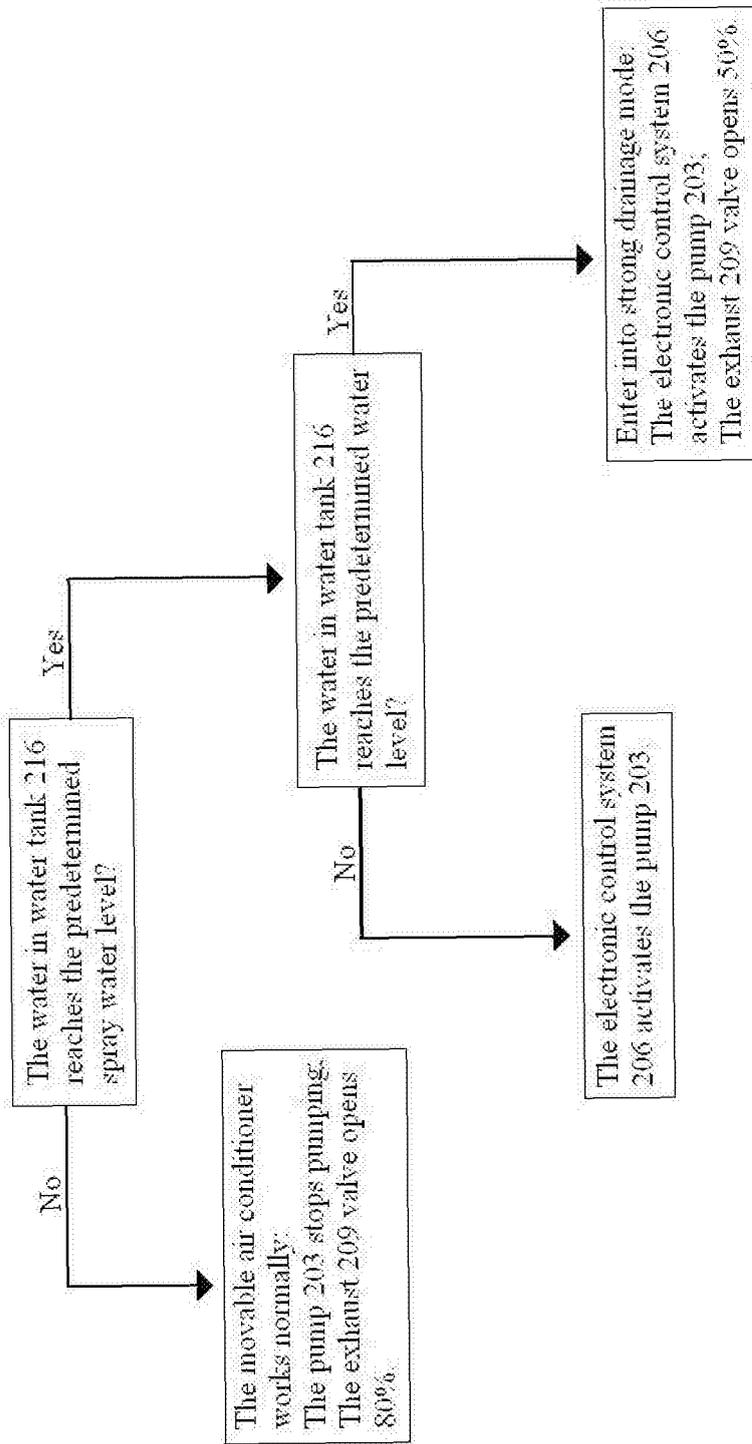


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2004/001515

A. CLASSIFICATION OF SUBJECT MATTER		
IPC ⁷ F24F13/22		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC ⁷ F24F13/22		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Chinese Patent Document		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
WPI,EPODOC,PAJ,CNPAT		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN, Y, 2212162 (Ding, Gang, Wang, Xuefa) 08.Nov.1995 (08.11.1995) the whole document	1-7
A	KR, A, 2002056040 (LG ELECTRONICS IN) 06.Aug.2003 (06.08.2003) the whole document	1-7
A	CN, A, 1362602 (LG ELECTRONICS IN) 07.Oct.2002 (07.08.2002) the whole document	1-7
A	JP, A, 2002-181346 (MITSUBISHI JUKOGYO KK) 26.Jun. 2002, (26.06.2002) the whole document	1-7
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
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Date of the actual completion of the international search 10.Mar. 2005 (10.03.2005)		Date of mailing of the international search report 31 · MAR 2005 (31 · 03 · 2005)
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INTERNATIONAL SEARCH REPORT
Information on patent family members

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