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(54) Title: SYSTEM INCLUDING A WASHER AND A DRYER

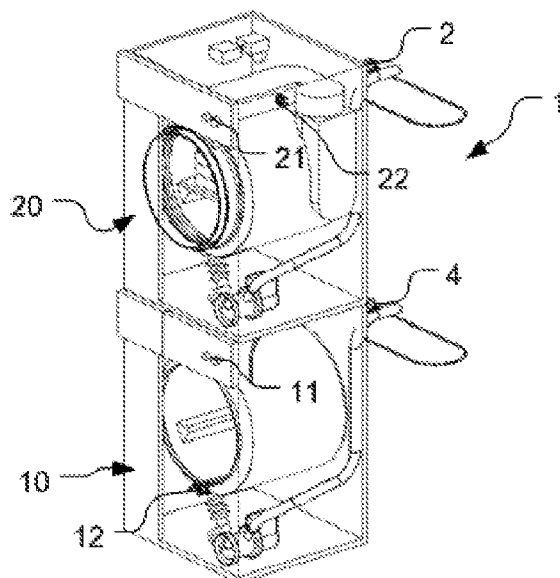


FIG. 1

(57) Abstract: A system includes a washer (10) and a dryer (20). The washer (10) includes a washer control system (11) for controlling an operation of the washer (10) and a washer heater (12), and the dryer (20) includes a dryer control system (21) for controlling an operation of the dryer (20) and a dryer heater (22). At least one of the washer control system (11) and the dryer control system (21) further includes a power source management module (23) for controlling a working current of the washer heater (12) or the dryer heater (22) according to a system working current. A control method of the system includes: electrically connecting a washer (10) and a dryer (20), turning on a power source to start working, detecting a system working current, and controlling a working current of the washer heater (12) or the dryer heater (22) according to the system working current. Through the system and the control method thereof, the system working current is controlled within a safety current range, and the safety of use of the system is enhanced.



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SYSTEM INCLUDING A WASHER AND A DRYER

The present invention relates to a system including a washer and a dryer, and more particularly to a combined clothes washer and dryer system capable of adjusting a
5 working current and a control method of the system.

In current household appliances, the combination of a washer and a dryer is increasingly more popular. Normally, the washer and the dryer have mutually independent heaters respectively, so that when the washer and the dryer are used at the same time, the two heaters work simultaneously, which may result in an excessively large working current of
10 the whole system, thereby possibly exceeding predetermined current load limits or even impairing safety. If the washer and the dryer are separately wired and connected to the power supply network, the cost will be increased.

In order to solve the above problems, different attempts have been published. For example, in U. S. Patent 3,824,813 a combined clothes washer and dryer system is disclosed, which system performs washing operation for the duration of which the power
15 to a dryer heater and a dryer motor is disabled by a latching relay, to keep a working current of the whole system within a certain range. However, at the moment when required to work, the dryer can only perform the drying operation by passing cold external air along the articles to be dried, without tumbling the articles. Obviously, this working
20 schedule has serious limitations; in particular, time for the drying operation is greatly prolonged, while the drying efficiency is difficult to guarantee. This results in very low work efficiency of the system.

According to U. S. Patent 4,663,948, a control circuit of a combined clothes washer and dryer system is disclosed. When the control circuit detects that a washer is working, the
25 control circuit performs half-wave adjustment on a dryer heater and a dryer motor through a diode serially connected to the dryer heater until the washer ends its program. Thereby a working current of the whole system is controlled within a predetermined current range to prevent the working current from being excessively high.

Although the above two patents provide for controlling a working current of the whole
30 system within a rated working current range, the work efficiency is sacrificed. In addition, the manner of controlling a working current of the whole system by controlling a dryer

heater or a dryer motor is not suitable for the case where a washer in an existing combined clothes washer and dryer system also has a heater. Moreover, in both of the two known schedules, control is performed in a mechanical manner, which makes the schedules inflexible.

- 5 The present invention is directed to a combined clothes washer and dryer system, capable of controlling a system working current flexibly.

In order to achieve the above object, the present invention provides a system which includes a washer and a dryer. The washer includes a washer control system for controlling an operation of the washer and a washer heater, and the dryer includes a dryer control system for controlling an operation of the dryer and a dryer heater. At least one of the washer control system and the dryer control system further includes a power source management module for controlling a working current of the washer heater or the dryer heater according to a system working current.

Beneficial effects include the following. The system working current is directly detected, so that a state of the system working current can be intuitively and effectively ascertained. Additionally, during working, the washer heater or the dryer heater require a large working current, so that the control on the working current thereof can control the system working current rapidly and effectively. Thereby the system working current is prevented from exceeding a safety range.

20 In a preferred embodiment of the present invention, the power source management module includes a control circuit for controlling the washer heater or the dryer heater. The control circuit includes a first switching device serially connected to the washer heater or the dryer heater, and a device for decreasing a working power of the washer heater or the dryer heater.

25 In another preferred embodiment of the present invention, the device for decreasing the working power of the washer heater or the dryer heater includes a diode connected in parallel with the washer heater or the dryer heater and a second switching device serially connected to the diode.

In another preferred embodiment of the present invention, the first switching device and the second switching device are relays.

In another preferred embodiment of the present invention, the power source management module includes a sampling circuit for collecting the system working current, an analog-to-digital converting device for performing analog-to-digital conversion on the collected system working current, and a comparing device for comparing a value obtained by performing the analog-to-digital conversion on the system working current with a preset safety working current value.

In another preferred embodiment of the present invention, the control circuit controls the working current of the washer heater or the dryer heater according to an output of the comparing device.

10 In another preferred embodiment of the present invention, the system includes a dryer power plug, a connection socket disposed on the dryer or the washer, and a washer power plug.

In another preferred embodiment of the present invention, when the washer and the dryer are used in a combined manner, the dryer power plug or the washer power plug is inserted into the connection socket.

The present invention is also directed to a control method of a combined clothes washer and dryer system, capable of controlling a system working current flexibly.

In order to achieve the above objects, the present invention provides a control method of a combined clothes washer and dryer system. The combined clothes washer and dryer system includes a washer and a dryer. The washer includes a washer heater, and the dryer includes a dryer heater. The method includes the following steps.

a) The washer and the dryer are electrically connected, and a power source is turned on to start working.

b) A system working current is detected.

25 c) A working current of the washer heater or the dryer heater is controlled according to the system working current.

In another preferred embodiment of the present invention, Step b includes collecting the system working current, and performing analog-to-digital conversion on the collected system working current.

5 In another preferred embodiment of the present invention, Step c includes comparing a value obtained by performing the analog-to-digital conversion on the system working current with a preset safety working current value, and controlling the working current of the washer heater or the dryer heater according to a comparison result.

10 In another preferred embodiment of the present invention, the step of controlling the working current of the washer heater or the dryer heater includes cutting off the working current of the washer heater or the dryer heater, or performing half-wave control on the washer heater or the dryer heater.

15 In another preferred embodiment of the present invention, when the value obtained by performing the analog-to-digital conversion on the system working current is greater than the safety working current value, the half-wave control is performed on the washer heater or the dryer heater, and the detection of the system working current is continued. If the value obtained by performing the analog—to-digital conversion on the system working current is still greater than the safety working current value, the working current of the washer heater or the dryer heater is disabled.

20 In another preferred embodiment of the present invention, when a washing program of the washer ends, or the washer heater completes heating, normal power supply to the washer heater or the dryer heater is restored.

25 Beneficial effects of the present invention are as follows. A washer and a dryer can work at the same time, an excessively large working current can be avoided, and high work efficiency is achieved. Meanwhile, due to adoption of logic control, increase of system cost is very small, and an actual working current can be judged quantitatively and precisely. Additionally, safety is enhanced, and the cost of separate electrical wiring for a large current borne by a user is reduced.

Preferred embodiments of the invention are now described in detail with reference to the attached drawing. In the drawing,

FIG. 1 is a three-dimensional perspective view of a combined clothes washer and dryer system;

FIG. 2 is a rear view of a combined clothes washer and dryer system;

FIG. 3 is a system circuit diagram of a combined clothes washer and dryer system;
and

FIG. 4 is schematic view of a control system of a combined clothes washer and dryer system.

Referring to FIG. 1, it is a three-dimensional perspective view of a combined clothes washer and dryer system. The combined clothes washer and dryer system includes a washer 10, a washer control system 11, a washer heater 12, a dryer 20, a dryer control system 21, and a dryer heater 22. The washer control system 11 controls a washing process of the washer 10, and the dryer control system 21 controls a drying process of the dryer 20.

Referring to FIG. 2 in combination to FIG. 1, the combined clothes washer and dryer system 1 further includes a dryer power plug 2 located in a rear end of the dryer 20, a connection socket 3 for external connection, and a washer power plug 4 located in a rear end of the washer 10. The connection socket 3 may be disposed in the rear end of the dryer 20 or in the rear end of the washer 10. When the whole system is used in a combined manner, the washer power plug 4 is inserted into the connection socket 3 to implement electrical connection. Definitely, the washer 10 and the dryer 20 may also be used separately, which can be achieved by just inserting the corresponding washer power plug 4 or the dryer power plug 2 into an external power supply. The dryer power plug 2, the connection socket 3, and the washer power plug 4 comply with the GB1002 standard.

Referring to FIG. 3 and FIG. 4 in combination, in order to control a working current of the whole system, the dryer control system 21 further includes a power source management module 23 for controlling the system current. Definitely, the power source management module 23 may also be disposed in the washer control system 11 to control the washer heater 12. Taking the power source management module 23 disposed in the dryer control system 21 as an example, the power source management module 23 includes a first control circuit 24 for adjusting a working current of the dryer heater 22. Preferably, the first

control circuit 24 includes a first relay 27 serially connected to the dryer heater 22, a diode 26 connected in parallel with the dryer heater 22, and a second relay 28 serially connected to the diode 26. When the second relay 28 is connected, half-wave control is performed on the dryer heater 22 to reduce the power by half. Accordingly, the washer control system 11 includes a second control circuit 14 for controlling an operation of the washer heater 12. Preferably, the second control circuit 14 includes a third relay 17 serially connected to the washer heater 12. When the third relay 17 is disconnected, the power supply to the washer heater 12 is stopped, and the washer heater 12 stops heating. In other embodiments, if the power source management module 23 is disposed in the washer control system 11, the second control circuit 14 includes a diode and a relay connected in parallel with the washer heater 12, so as to perform half-wave control on the washer heater 12.

In order to further perform logic control on the system working current, the power source management module 23 further includes a sampling circuit 5, an analog to digital converting device 6, and a comparing device 7. The sampling circuit 5 includes a sampling resistor 8 for collecting a current of a working circuit of the system. When the system is in a working mode, that is, the washer power plug 4 is inserted into the dryer connection socket 3, the power source is turned on to enable the washer 10 and the dryer 20 to start working. If the first relay 27 and the third relay 17 are connected, and the second relay 28 is disconnected, both the washer heater 12 and the dryer heater 22 are in a normal working state. At the moment, the system working current of the combined clothes washer and dryer system 1 may exceed a normal working current, thereby generating safety hidden dangers. The power source management module 23 collects the system working current through the sampling circuit 5, performs analog to digital conversion on the collected current value through the analog to digital converting device 6, and compares the converted value with a preset safety working current through the comparing device 7. The safety working current value may be changed according to actual situations to meet requirements of various customers in various regions. When it is judged that the actually collected working current is greater than the safety working current, the power source management module 23 enables the second relay 28 to be connected to perform the half-wave control on the dryer heater 22. If at the moment, the system working current collected by the power source management module 23 through the sampling circuit 5 is still greater than the safety working current, the first relay 27 is

disconnected to enable dryer heater 22 to stop working, so as to guarantee that the system working current is within a safety working current range. When a washing program of the washer 10 ends or the washer heater 12 completes heating, the working current of the whole system is inevitably decreased. Upon receiving a feedback signal from the sampling circuit 5, the power source management module 23 enables the first relay 27 to be connected and the second relay 28 to be disconnected, and at the moment, the dryer heater 22 is supplied with power normally and continues heating. If at the moment, it is detected that the system working current is greater than the working current, the second relay 28 is connected to perform the half-wave control on the dryer heater 22.

Therefore, in the combined clothes washer and dryer system according to the present invention, logic judgment can be performed on the system working current through the power source management module in a real time manner, and the working current controlling the dryer heater or the washer heater can be controlled separately according to a judgment result. The power to the heater may be completely cut off, or the half-wave control may be performed on the heater, so that the working current of the whole system is decreased to be within the safety working current range. The whole process is implemented completely by logic control, and the control manner is flexible and precise, so that the safety of the system is greatly enhanced, and the cost of separate electrical wiring for a large current born by a family is avoided. Furthermore, in the above embodiment, when the washing program of the washer ends or the washer heater completes the heating, the power source management module can restore the power supply to the dryer heater, which increases the work efficiency of the system on the basis of safety electricity consumption.

The above illustrated embodiments are merely preferred embodiments of the present invention. The present invention also has other embodiments. It should be understood that, equivalent modifications to the present invention made under the instruction of the present invention should be included within the scope of the invention as presented in the appended claims.

CLAIMS

- 5 1. A combined system (1) comprising a washer (10) and a dryer (20), wherein the washer (10) comprises a washer control system (11) for controlling an operation of the washer (10) and a washer heater (12), the dryer (20) comprises a dryer control system (21) for controlling an operation of the dryer (20) and a dryer heater (22), **characterized in that** at least one of the washer control system (11) and the dryer control system (21)
- 10 further comprises a power source management module (23) for controlling a system current.
2. The system (1) according to claim 1, characterized in that the power source management module (23) comprises a first control circuit (24) for controlling the washer
- 15 heater (12) or the dryer heater (22), and the first control circuit (24) comprises a first current control device (25) for adjusting a working current of the first control circuit.
3. The system (1) according to claim 2, characterized in that the first current control device (25) is a rectifying device.
- 20 4. The system (1) according to claim 3, characterized in that the first current control device (25) comprises a diode (26) connected in parallel with the first control circuit (24) and a first relay (27) for controlling the diode (26).
- 25 5. The system (1) according to claim 1, characterized in that the washer control system (11) comprises a second control circuit (14) for controlling the washer heater (12).
6. The system (1) according to claim 5, characterized in that the second control circuit (14) comprises a second current control device (15) for adjusting a working current
- 30 of the second control circuit.

7. The system (1) according to claim 6, characterized in that the second current control device (15) comprises a second relay (17) serially connected to the second control circuit (14).

5 8. The system (1) according to one of the preceding claims, characterized in that it further comprises a dryer power plug (2), an external socket (3) that is provided for external connection, and a washer power plug (4).

9. The system (1) according to claim 8, characterized in that the dryer power plug (2),
10 the external socket (3), and the washer power plug (4) conform to a standard.

10. The system (1) according to one of claims 8 and 9, characterized in that when the washer (10) and the dryer (20) are provided for use in a combined manner, the washer power plug (4) is inserted into the external socket (3).

15

11. The system (1) according to one of the preceding claims, characterized in that the power source management module (23) further comprises a sampling circuit (5), an analog to digital converting device (6), and a comparing device (7).

20 12. The system (1) according to claim 11, characterized in that the sampling circuit (5) comprises a sampling resistor (8) for collecting current of a working circuit of the system.

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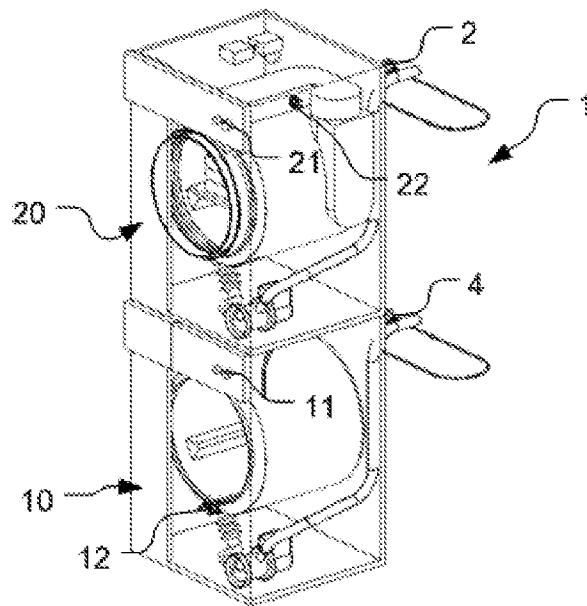


FIG. 1

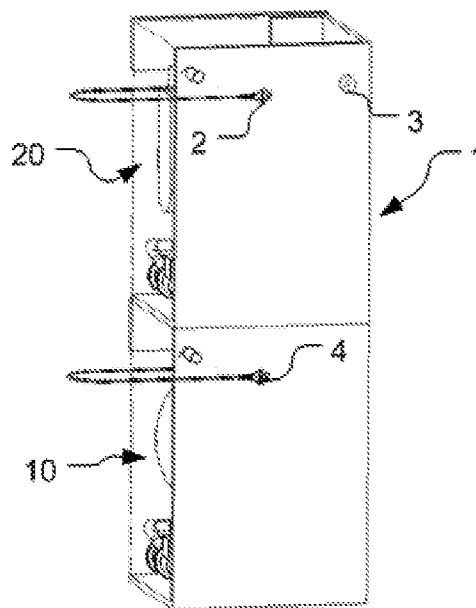


FIG. 2

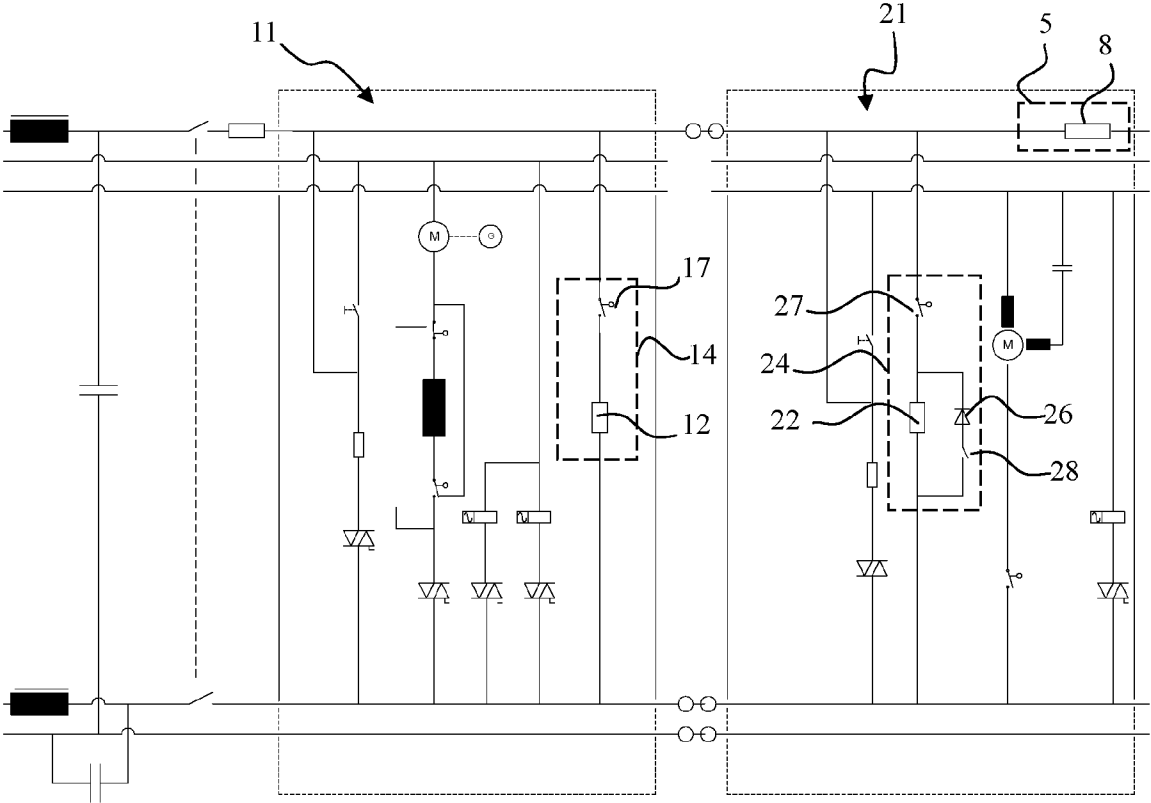


FIG. 3

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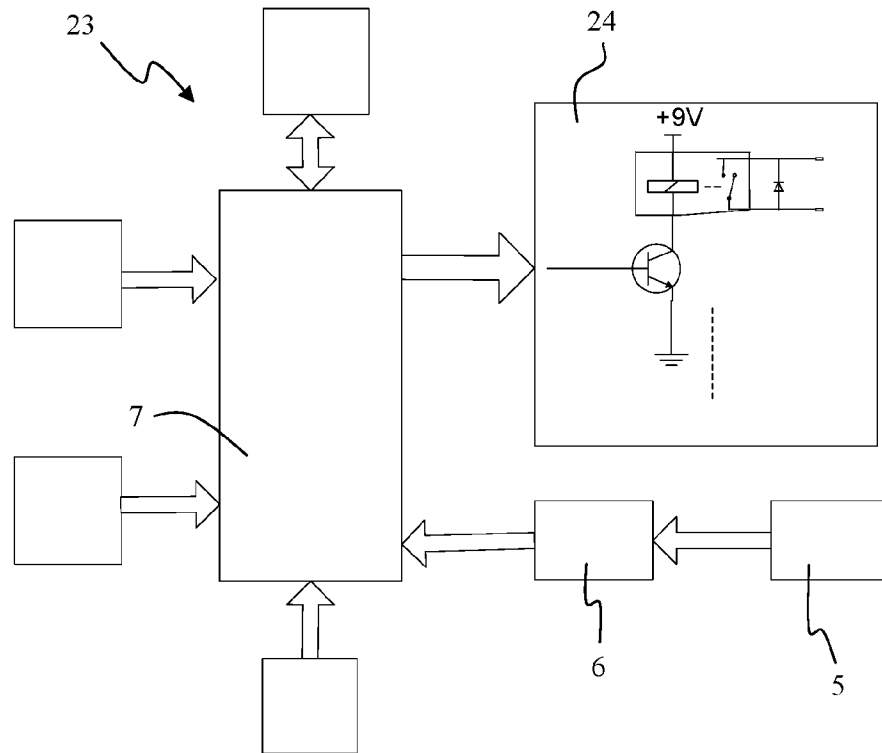


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. D06F29/00
ADD. D06F58/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
D06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 663 948 A (RUMMEL RAYMOND W [US]) 12 May 1987 (1987-05-12) cited in the application	1-7
Y	column 2, line 23 - column 5, paragraph 63; figures 1-2	8-12
X	US 3 540 241 A (JACOBS JAMES W) 17 November 1970 (1970-11-17)	1,2,5,6, 8-10
Y	column 1, paragraph 13 - column 3, paragraph 7; figures 1-2	8-10
X	US 4 510 778 A (COTTON CURRAN D [US]) 16 April 1985 (1985-04-16) column 2, line 7 - column 8, paragraph 46; figures 1-3,7-8	1,2,5,6, 8,9
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Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2010/066856

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 824 813 A (DAVIS T) 23 July 1974 (1974-07-23) cited in the application column 1, paragraph 57 - column 4, paragraph 7; figures 1-2 -----	1,2,5,6, 8,9
Y	JP 3 026297 A (TOSHIBA CORP; TOSHIBA AUDIO VIDEO ENG) 4 February 1991 (1991-02-04) * abstract; figures 1-3 -----	11,12
A	DE 198 02 650 A1 (AEG HAUSGERAETE GMBH [DE]) 29 July 1999 (1999-07-29) the whole document -----	1-12

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2010/066856

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4663948	A	12-05-1987	CA 1244117 A1	01-11-1988
US 3540241	A	17-11-1970	NONE	
US 4510778	A	16-04-1985	CA 1235467 A1	19-04-1988
US 3824813	A	23-07-1974	NONE	
JP 3026297	A	04-02-1991	NONE	
DE 19802650	A1	29-07-1999	NONE	