

Fig. 10 is a configuration diagram of a control apparatus 100 according to Embodiment 3.

Fig. 11 is a flowchart showing the operation of a middleware part 20 according to Embodiment 3.

5 Fig. 12 is a table showing arbitration information concerning phase 1 according to Embodiment 3.

Fig. 13 is a configuration diagram of a control apparatus 100 according to Embodiment 4.

10 Fig. 14 is a configuration diagram of a middleware part 20 according to Embodiment 4.

Fig. 15 is a flowchart showing the operation of the middleware part 20 according to Embodiment 4.

Fig. 16 is a table showing arbitration information concerning phase 1 according to Embodiment 4.

15 Fig. 17 shows a case in which the control apparatus 100 is built in an air-conditioner.

Fig. 18 is a chart showing secondary requests outputted in the case shown in Fig. 17.

20 Fig. 19 shows a case in which a general control apparatus is built in an air-conditioner.

Fig. 20 is an explanatory diagram of a DC (direct current) motor-driven automated cart.

Fig. 21 shows a case in which the control apparatus 100 is built in the automated cart shown in Fig. 20.

25 Fig. 22 shows an example of the hardware configuration of a control apparatus

having the highest priority from among the inputted primary requests.

[0034] Fig. 7 is a configuration diagram of a control apparatus 100 according to Embodiment 2.

The control apparatus 100 according to Embodiment 2 is different from the control apparatus 100 according to Embodiment 1 in that each phase is determined to be either a selection phase or a combination phase.

The selection phase is a phase described in Embodiment 1. That is, in the selection phase, one primary request is selected from among a plurality of inputted primary requests.

The combination phase is a phase of generating a new primary request that realizes two or more primary requests simultaneously. In the combination phase, a new primary request is generated to correspond to the combination of inputted operation requests.

[0035] The configuration of a middleware part 20 according to Embodiment 2 is the same as the configuration of the middleware part 20 according to Embodiment 1 shown in Fig. 2. The middleware part 20 according to Embodiment 2 is different from the middleware part 20 according to Embodiment 2-1 in arbitration information stored by an arbitration information storage part 22.

Concerning the selection phase, the arbitration information storage part 22 stores the priorities as the arbitration information, in the same manner as in Embodiment 1. Concerning the combination phase, however, the arbitration information storage part 22 stores, as the arbitration information, combination information that determines a new primary request to be generated to correspond to the combination of the inputted primary requests.

If the arbitration information is combination information, a request generating

from the function execution part 12B, to phase 1, and supplies, as input, the weak-protection function outputted from a function execution part 12C, to phase 2 (S21).

The request generating part 23 initializes the variable i to 1 (S22), arbitrates the contention concerning phase 1, in the same manner as in stage 3, and supplies, as input, the rapid-cooling & ice-making request to phase 2 (S23-S25). Then, the request generating part 23 adds 1 to the variable i to obtain 2, and puts the process back to ~~S3-~~ S23 (S26).

The request generating part 23 arbitrates the contention concerning phase 2 (S23). Since the rapid-cooling & ice-making request inputted from phase 1 and the weak-protection request outputted from the function execution part 12C are inputted, the request generating part 23 arbitrates the contention in accordance with the arbitration information shown in Fig. 6. As a result, the weak-protection request having a higher priority is selected. Since phase 2 is the last phase (YES in S24), the request generating part 23 outputs the weak-protection request selected in S23 to the device control part 30 as the secondary request (S27).

In brief, at this point, the weak-protection request is outputted to the device control part 30, and the compressor operates at the 2nd speed.

[0042] As described above, the control apparatus 100 according to Embodiment 2 stores the combination information as the arbitration information, so that a new primary request that realizes two or more primary requests simultaneously can be generated.

Hence, while simplifying the function of arbitrating the contending operation requests in the same manner as in Embodiment 1, control can be carried out more flexibly than in Embodiment 1.

[0043] Embodiment 3.

adds 1 to the variable i to obtain 2, and puts the process back to S43 (S46).

The request generating part 23 arbitrates the contention concerning phase 2 (S43). Since the ice-making request inputted from phase 1 and the weak-protection request outputted from the function execution part 12C are inputted, the request
 5 generating part 23 arbitrates the contention in accordance with the arbitration information shown in Fig. 6. As a result, the weak-protection request having a higher priority is selected. Since phase 2 is the last phase (YES in S44), the request generating part 23 outputs the weak-protection request selected in S43 to the device control part 30 as the secondary request (S47).

10 In brief, at this point, the weak-protection request is outputted to the device control part 30, and the compressor operates at the 2nd speed.

[0063] As described above, the control apparatus 100 according to Embodiment 4 stores the new correction information so as to correct the primary request generated in the previous phase, thereby generating a new primary request.

15 Hence, while highly simplifying the function of arbitrating the contending operation requests in the same manner as in Embodiments 1 to 3, control can be carried out more flexibly.

[0064] In the above explanation, if an additional function is not active, the operation speed of the compressor is always 4th speed. However, even if the additional function
 20 is not active, the operation speed of the compressor may be altered depending on the ambient temperature or the like of the refrigerator, for the purpose of keeping, for example, a constant refrigerator temperature. In brief, the basic operation execution part 11 may output a basic request requesting different operation speeds depending on the ambient temperature or the like of the refrigerator.

25 In that case, as described in Embodiment 4, when the additional function such

MIN frequency protection (protection function 3) is a function that maintains the minimum operation speed so as to ensure the refrigerant circulation amount. This is because if the operation speed decreases more than necessary, it imposes a load to the compressor. When the operation speed falls below a predetermined speed, the

protection function 3 sets the operation speed of the compressor to the minimum speed.

Countermeasure for vibration in stopping (protection function 4) is a function that prevents the piping from being disconnected by vibration occurring when stopping the compressor. The protection function 3⁴, before the compressor is stopped, sets the operation speed of the compressor to a predetermined speed for a predetermined period

of time.

Discharge overrise stop (protection function 5) is a function that brings the compressor to emergency stop when a sensor detects an abnormal rise in the temperature or pressure of the discharge gas. The protection function 5 sets the operation speed of the compressor to 0.

[0068] Primary requests outputted from the basic operation and the additional function 1 are inputted to phase 1 (correction phase). A primary request outputted from the additional function 2 is inputted to phase 2 (selection phase). Primary requests outputted from the protection functions 1 and 2 are inputted to phase 3 (correction phase). Primary requests outputted from the protection functions 3, 4, and 5 are inputted to phase 4 (selection phase).

In phase 3, as arbitrary information, combination information is set according to which: if only the protection function 1 is active, the correction value of the protection function is selected; if only the protection function 2 is active, the correction value of the protection function 2 is selected; and if both the protection functions 1 and 2 are active, both of the two correction values are selected.

Claims

[Claim 1] A control apparatus which arbitrates contending operation requests outputted from a plurality of APPs, APP standing for application program, and controls a device, comprising:

- 5 a request input part which supplies, as input, the operation requests outputted from the APPs, each to a phase predetermined for a corresponding APP among a plurality of phases arranged in a fixed order;
- an arbitration information storage part which stores, for each phase, arbitration information;
- 10 a request generating part which generates an operation request, being a result of arbitrating a contention of the operation requests inputted, in the phases sequentially starting with the first phase and in accordance with the arbitration information stored in the arbitration information storage part, and supplies, as input, the operation request generated, to a next phase, thereby arbitrating the contention of the operation requests
- 15 step by step; and
- a device control part which controls an operation of the device in accordance with the operation request generated by the request generating part in the last phase.

[Claim 2] The control apparatus according to claim 1,

- wherein the arbitration information storage part, concerning a selection phase
- 20 among the plurality of phases, stores a priority concerning the operation request inputted, as the arbitration information, and
- wherein the request generating part, when in the selection phase, selects a single operation request having a high priority from among the operation requests inputted, and supplies, as input, the operation request selected, to a next phase.

25 [Claim 3] The control apparatus according to claim 1 or 2,

- wherein the arbitration information storage part, for a combination phase

[Claim 6] The control apparatus according to any one of claims 1 to 5,
 wherein the request input part supplies, as input, an operation request having a
 higher priority to an earlier or later phase.

[Claim 7] A control method of arbitrating contending operation requests
 5 outputted from a plurality of APPs, APP standing for application program, and
 controlling a device, comprising:

 a request input step of, with a processing device, supplying, as input, the
 operation requests outputted from the APPs, each to a phase predetermined for a
 corresponding APP among a plurality of phases arranged in a fixed order;

10 a request generating step of, with the processing device, generating an
 operation request, being a result of arbitrating a contention of the operation requests
 inputted, in the phases sequentially starting with the first phase and in accordance with
 arbitration information stored in a storage device in advance for each phase, and
 supplying, as input, the operation request generated, to a next phase, thereby arbitrating
 15 the contention of the operation requests step by step; and

 a device control step of, with the processing device, controlling an operation of
 the device in accordance with the operation request generated in the request generating
 step in the last phase.

[Claim 8] A control program which arbitrates contending operation requests
 20 outputted from a plurality of APPs, APP standing for application program, and controls
 a device, comprising:

 a request input process of supplying, as input, the operation requests outputted
 from the APPs, each to a phase predetermined for a corresponding APP among a
 plurality of phases arranged in a fixed order;

25 a request generating process of generating an operation request, being a result
 of arbitrating a contention of the operation requests inputted, in the phases sequentially

starting with the first phase and in accordance with arbitration information stored in a storage device in advance for each phase, and supplying, as input, the operation request generated, to a next phase, thereby arbitrating the contention of the operation requests step by step; and

- 5 a device control process of controlling an operation of the device in accordance with the operation request generated in the request generating process in the last phase.