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Air Conditioning Modification into Crystal Ice Machine with Fast Cooling Based on Smart Relay

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Abstract— *The working principle of the Air Conditioner which consists of the process of using a refiner using a dry type evaporator, which results in the evaporator cooling will be sent by the fan into the room so that it becomes cold. By changing the evaporator into a crystal or ice tube mold, the conversion process will no longer be distributed indoors, but will be focused on the crystalline or ice tube molds. With a system that regulates using smart relays, it is hoped the freezing and thawing processes can be faster and more optimal*

Keywords— *Air Conditioner, Refigeran, Evaporator, Smart Relay.*

I. PRELIMINARY

The process of producing ice in a conventional system requires quite a long time. For example freeser machines in households to be able to freeze ice perfectly takes approximately 12 hours, as well as ice blocks processed at the factory. From this background we took the initiative to make an ice machine which is a modification of the air conditioning system with a very fast freezing process. The ice machine that we made only requires production time until the ice comes out for about 30 minutes automatically using a smart relay. The ice molding machine that we use is in the form of a stainless tell pipe which we arrange vertically and lined up inside the evaporator which is in accordance with the capacity of the machine.

II. RESEARCH METHODS

1. Working diagram of the ice machine

Refigeran will be sprayed with high pressure using the compressor into the evaporator through solenoid valve 1, which contains pipes that are ice molds. The pipes will be drained by water that is pumped from the bottom up then will go down through the holes of the pipes that have been frozen by the refigrant, so that the water flowing through the pipes will get stuck and freeze. Water that has not yet frozen will go down to the water reservoir below which will then be raised again by the pump upward to flow again into the pipe. So that the pipe will form a layer of ice that is increasingly thickening. After the pressure in the evaporator is low enough to be read by the pressure switch, the freezing process has been completed and the solenoid valve 1 will close, which will be followed by the process of releasing ice from the mold by inserting the refigrant hot gas from the condenser into the evaporator through the solenoid valve 2. So that the ice will come out of the pipe and will go down. After the ice goes down the next process will be cut by a cutter that is driven by a motor. The cut ice will go down into a rotating disk that moves along with the cutting knife, then the ice will come out through the turning blade. After the ice runs out the cycle will start all over again automatically. We control this automatic process using Smart Relay.

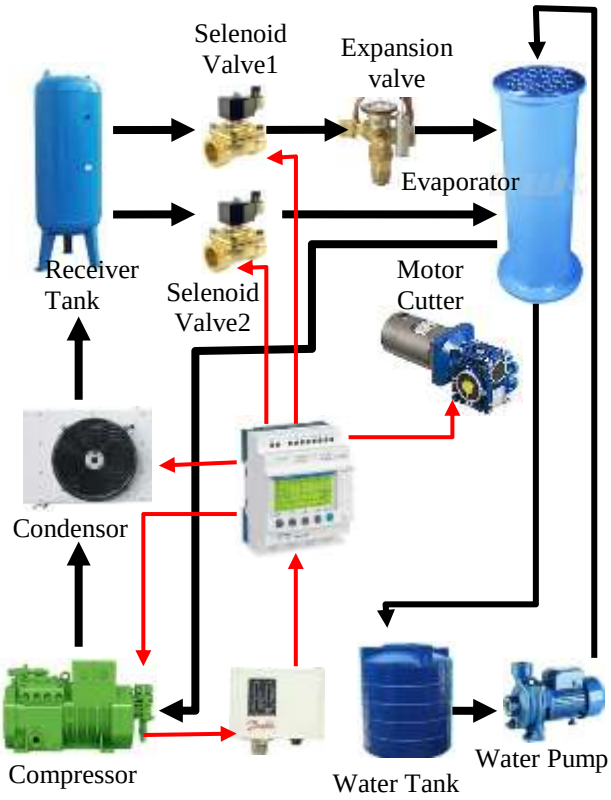

Figure 1. Work diagram of a crystal ice machine

Figure 2. Smart Relay

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2. Smart Relay

Smart relay is a component of a microprocessor based on the arduino microcontroller. Smart relay in it is already equipped with analog and digital inputs with output in the form of a relay. Smart relay programming using ladder language and Blog Diagram Function (FBD)

III. Research Results and Discussion

1) Ladder diagram of the ice machine

In this ladder diagram programming uses 4 digital inputs. I1 is used for the start button, I2 for the stop button, I3 for low pressure sensors, I4 for high pressure sensors. Inputs I1 and I2 come from the start and stop buttons, while input 3 and 4 come from the Presure switch, where the pressure switch is connected to the compressor.

At this smart relay output will be connected to the contactor, where the contactor will later activate equipment such as compressors, condensors, water pumps, motor cutting and solenoid valves. At Output Q1 is used to activate the main contactor which is connected to the compressor. At Output Q2 it is used for the freezing process, connected to Selenoid valve 1 and the water pump. At Output Q3 is used for the Defroze process or the process of melting ice connected to a solenoid valve 2. While Q4 is used for the process of cutting ice that is connected to the motor cutter.

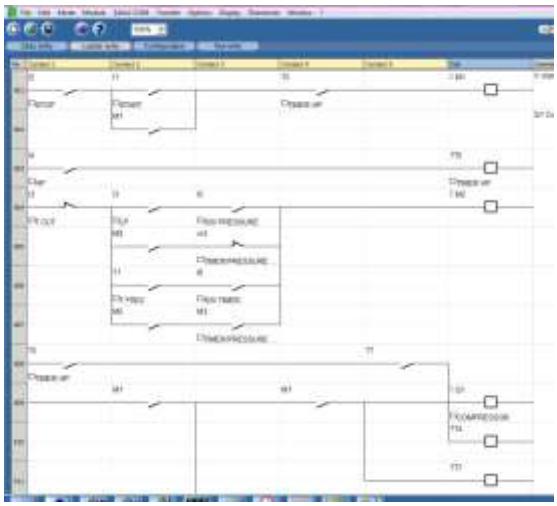

Figure 3. Ladder diagram

2) Single line Diagram

Figure 4 is a single line diagram of the ice tube machine control circuit. SV1 and SV 2 work alternately. When freezing SV1 will be on and SV 2 will be off, while at Defroze or the process of melting ice then SV1 will be off and SV2 will be on.

3) Tool Testing Results

In the table, if the value is 1, then the position is on, if it is 0, then the position is off. In the first experiment the highest compressor pressure is 250 psi and the low pressure is 60 psi, at this stage a freezing process occurs. In this freezing process if the temperature drops then the pressure on the low pressure side of the compressor will drop. From the results of observations the water will freeze at a low pressure position at 40 psi. in this phase it takes 30 minutes at a room temperature of 30 degrees Celsius. In the second experiment the compressor's low pressure drops to 40 psi, so the pressure switch on I3 will be 1 or On. When I3 is 1, the next process is the melting of the ice in the evaporator with an indication that Q3 will be on which will open the solenoid valve 3 which directs the hot Freon directly to the evaporator without passing through the expansion valve. In this process it takes 10 minutes.

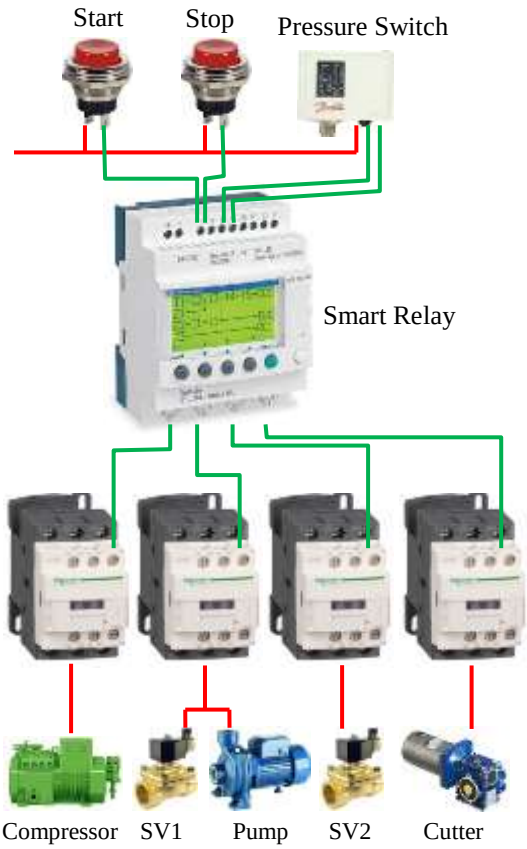

Figure 4. Single Line Diagram

TABLE 1. Ladder diagram test results

No	Pressure		I1	12	13	14	QI	Q2	Q3	Q4
	H	L								
1	250	60	1	1	0	0	1	1	0	0
2	220	40	1	1	1	0	1	0	1	1
3	270	40	1	1	0	1	0	0	0	0

Figure 5. Modification of ice machine and smart relay control panel results

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IV. Conclusion

In this ice machine modification evaporator system uses a wet evaporator, where the refigrant will directly hit the ice mold in the form of an iron pipe without passing through other media so that the cooling process becomes faster. While the process of melting ice directly fires refigant liquid which is still in the form of hot gas in the receiver tank directly to the evaporator without passing through the expansion valve. So that the melting process will be faster. With the help of a smart relay, the automation process on this ice machine is better than the manual system.

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