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Cold Storage Condenser Heat Recycling and Energy Saving System Research

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ABSTRACT: The principle of cold storage refrigeration system is refrigerant in the effect of the gasification and heat in the refrigerator, However, after the refrigerant in the condenser liquefaction heat release, and the heat emissions into the atmosphere directly. Therefore, this paper presents a condenser heat secondary recycling using system, through the series between the compressor and condenser phase change thermal storage, and Condenser external phase change thermal storage to realize to the condenser heat recycled using. Using the phase transition process of phase change heat storage material condensing heat recovery and cooling system for making hot water, not only realize the condensing heat recycling and reduce the emissions of greenhouse gases and air pollution, at the same time solve the refrigeration system operation period and hot water use the amount of time lag and living hot water and inconsistent problems between the condensing heat. Reasonable change condensing unit operation and make full use of the exhaust heat of condensing unit to provide living hot water, Can reduce air pollution and greenhouse gas emissions, improve the urban atmospheric environment, has more significance of energy conservation and environmental protection.
Keywords: Cold storage system; Phase change heat storage; Waste heat recovery; Energy conservation and emissions reduction

I. INTRODUCTION

Usually,Refrigeration system consists of refrigeration compressor, condenser, expansion valve, evaporator, etc[1],between them with refrigerant circulation pipeline are concatenated together.When the refrigeration system work,Low temperature refrigeration compressor are inhaled refrigerant gas compression,formation of high temperature and high pressure gas refrigerants condensation heat release into the condenser,flow condenser of refrigerant in low temperature, high pressure, the density of its liquid,further into the expansion valve,when low temperature high pressure liquid refrigerant from tiny pipe into the expansion valve burst open,The swelling volume and rapid gasification,And then into the evaporator,Absorb a large number of cooling effect of the heat.Refrigerant from the evaporator is low temperature low pressure gas,Then in the compressor is compressed and complete a complete refrigeration cycle.In the refrigeration cycle described above, by the heat coming from the condenser directly discharged into the environment[2].

II. STATUS AND TRENDS

At present, waste heat recovery system of condenser in refrigeration storage does not have practical and thorough research[3]. Most of domestic refrigeration storage system do not use any waste heat recycling device and heat energy emitted by condenser all emit into atmosphere. From the perspective of domestic research status of waste heat recovery system, there are two main methods to recovery: heating tap water directly or using water tank's sensible heat recovery[4]. The former has to solve the problem of time difference between system run-time and hot water usage period as well as the difference between the amount of domestic hot water and condenser heat[5]; the latter also has the problem with a large heat storage tank and the temperature and amount of water supply are not stable enough.

In recent years, refrigeration storage construction has developed rapidly in China, mainly located in the main producing areas of fruits and vegetables and vegetables base in the suburb of large and middle-sized cities[6]. According to statistics, the existing refrigeration capacity has reached more than 5 million tons, foreign investment, Sino-foreign joint venture and private refrigeration storage accounting for 500 thousand tons, state-owned storage accounting for more than 4.5 million tons, belonging to domestic trade, agriculture, foreign trade and light industry system[7]. Storage capacity of domestic trade reached over 3 million tons, occupying more than 60% of total in the whole country. China's commercial system owns more than 2 million square meters of storage for fruits and vegetables with a capacity over 1.3 million tons, over 700 thousands tons of machinery refrigeration storage and 600 thousands tons of ordinary storage[8].

Thus,along with the constant growing of the market requirement, the accelerating construction speed and the scale of production of cold storage also constantly accelerate. So that the waste amounts of exhaust heat of the refrigeration system will be very considerable. The heat generated by the refrigeration system can be made

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full use in our living hot water supply, etc, it can make outstanding contribution for the economical utilization of social resources[9].The system not only reduces the hot water production cost, improve the energy utilization of system, and the water temperature is more stable. Secondly, the influence of the phase change materials by the condition such as temperature difference can be detected through the phase change heat storage device, it can give full play to the material performance of the phase change materials, then, this can improve the reliability of system.

III. SYSTEM TECHNICAL SCHEME AND THE EXPERIMENT

Usually, Cold storage refrigeration system consists of compressor, condenser, expansion valve, condenser and a refrigerant flow pipe of concatenated[10].Cooling system work, refrigeration principle relies mainly on the refrigerant liquefaction process exothermic and endothermic gasification to achieve the external environment temperature regulation. Specific process is, in the process of circulation inhaled as refrigerant in the low temperature gas compressor is compressed, compressed into high temperature and high pressure gas condensation process, into the condenser refrigerant is out after low temperature high pressure liquid refrigerant, and then into the expansion valve quickly after gasification into the refrigerator heat and cooling effect, discharge refrigerant compressor for into the circulation, such a process of repeated cycle constitutes the refrigeration cycle system[11-13]. As shown in figure:

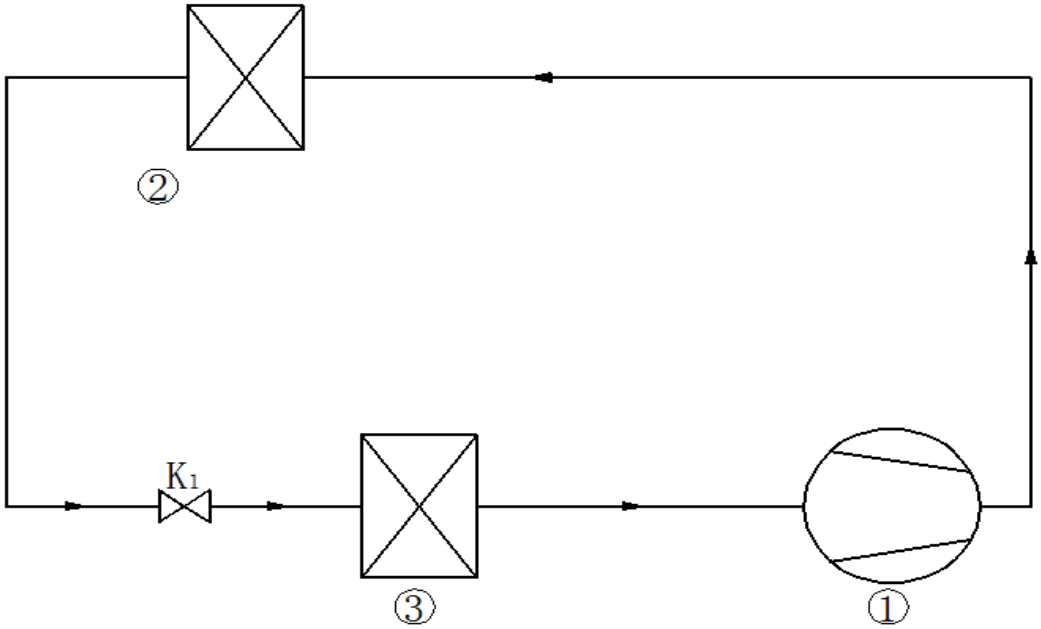

Figure 1 .Cold storage system schematic diagram
①Compressor ②Condenser ③Refrigerator K1-Expansion valve

However, from the refrigeration cycle process of the refrigeration system, refrigerant in the condenser of condensing refrigerant liquid release heat in the process of direct emissions into the atmosphere environment[14-15]. Therefore, in order to respond to a nation in improving energy utilization and increase the intensity of protecting the environment, to improve the traditional refrigeration system, this paper use of refrigerating unit discharge heat for hot water supply system. It not only improve the utilization rate of energy, but also made outstanding contribution to the protection of the environment.

3.1 REFRIGERATION SYSTEM OF WASTE HEAT OF SECONDARY RECOVERY SYSTEM

Refrigeration system of waste heat of secondary recovery system is based on waste heat recovery system based on the proposed. System of secondary recovery of waste heat in series between the compressor and condenser phase change thermal storage, also added a on the outside of the condenser phase change thermal storage, intensify the recycling of waste heat. System as shown in figure:

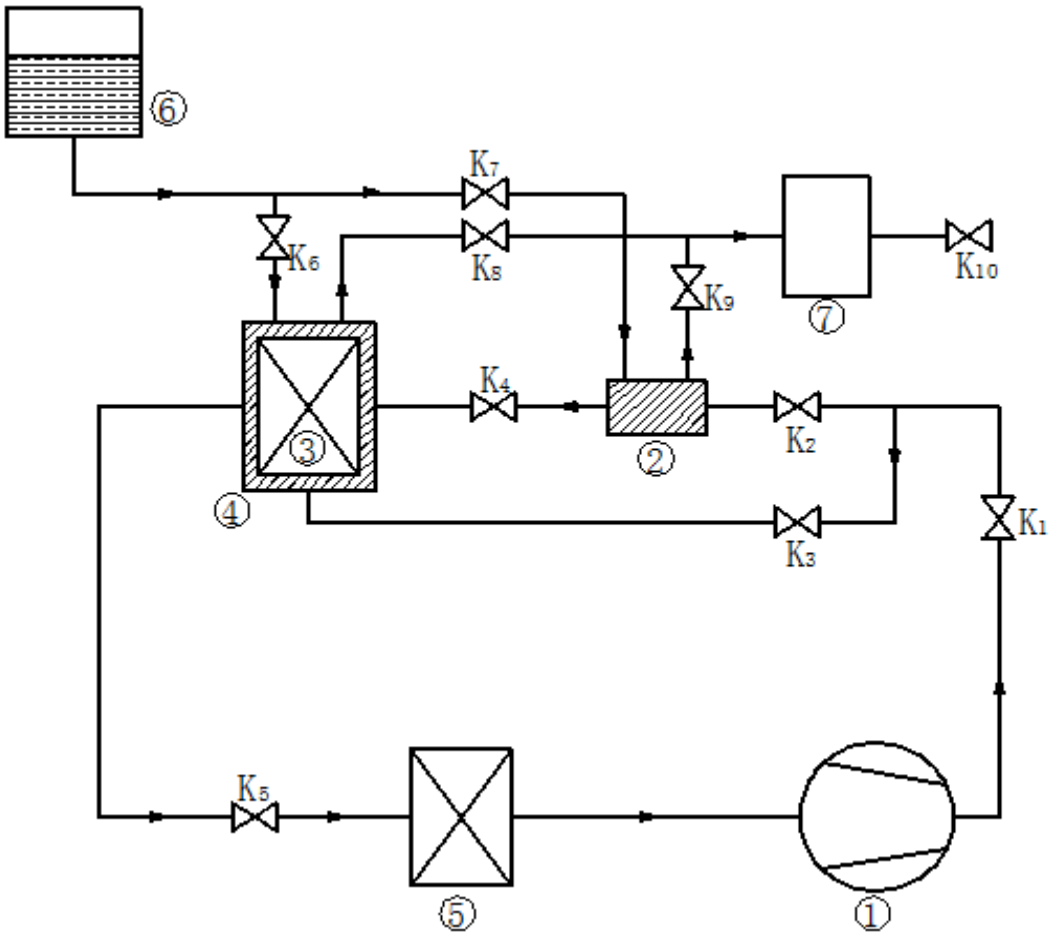

Figure 2 .Refrigeration system of waste heat of secondary recovery system
①Compressor②Phase change thermal storage 1 ③Condenser ④Phase change thermal storage 2⑤Refrigerator⑥water tank ⑦The heater K1-K10 valve switch

System works: refrigerant through the compressor compressed, compressed into high temperature and high pressure gas flow, and then transfer to the phase change heat storage phase change thermal storage, if in 1 out of coolant temperature phase change thermal storage and conventional refrigeration system in a state of refrigerant flow condenser, at this point can be directly through the electronic expansion valve, and then into the refrigerator for cooling; If the phase change thermal storage 1 out of state of refrigerants compared with the conventional high temperature, also need through the condenser again condensation heat release, and then continue to refrigeration cycle. And also to the condenser phase change heat storage gives off heat, this is the second heat storage, improve the power of heat recovery, and increase the protection of environment. With two heat storage of waste heat recycling system, intensify of heat recovery, and effectively improve the heat waste.

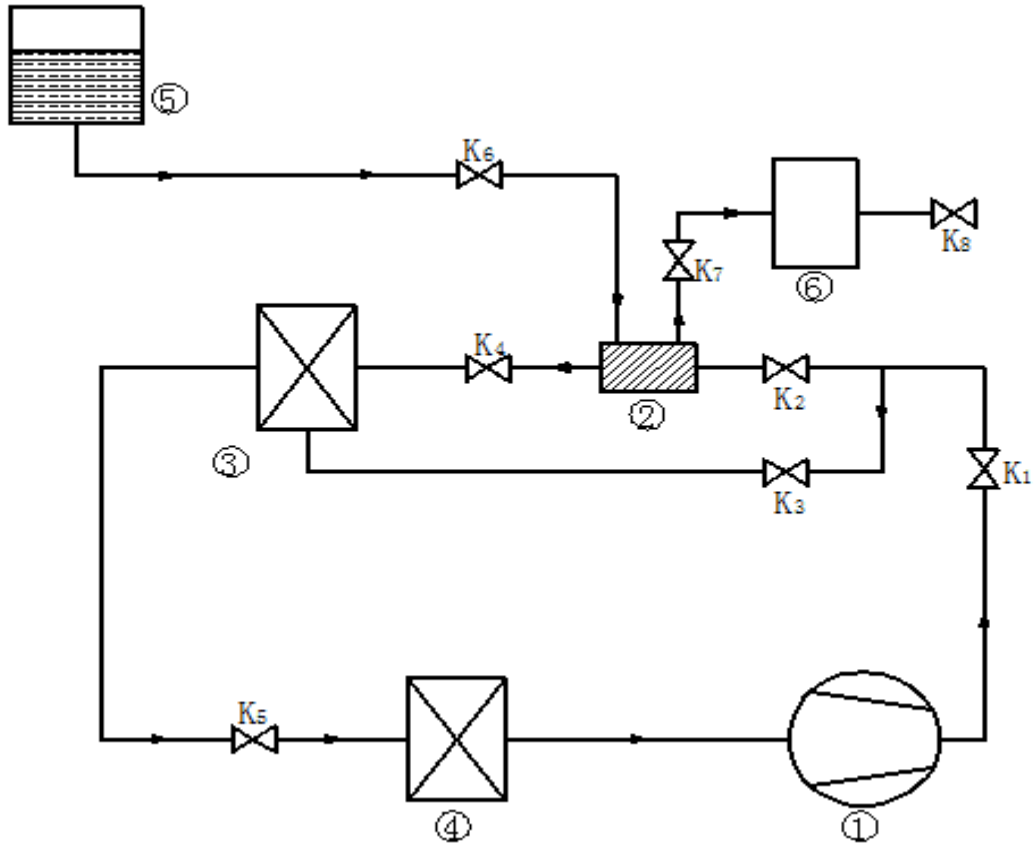

Figure 3 .The refrigeration system of waste heat recovery system at a time ①Compressor②Phase change thermal storage③Condenser ④refrigerator ⑤water tank ⑥The heater KX-valve switch

Compared the above two refrigeration system can be obtained with the secondary recovery of waste heat system more in line with the requirements for energy and the environment. In view of this, need to prove the conclusion, the need to do the following experiment. Experimental, waste heat recovery system for the second time two accumulators heat experiment; the second experiment, with or without refrigeration system of refrigerator running experiments of heat accumulator; third, regenerative heat accumulator test and preparation of hot water test.

Through the experimental one is to prove that the waste heat recovery system and the waste heat recovery system in two times, compared with other relevant requirements are satisfied, the two recycling system of waste heat energy utilization rate is higher, the environmental protection strength is greater, the system load will not produce the correlation effect.

The purpose of experiment two is to verify the feasibility of waste heat recovery system. The system does not have an adverse effect on the refrigeration cycle system, which will not cause the disorder of refrigeration cycle and reduce the cooling effect.

The purpose of experiment three is to explain the adjustable degree of the system and the extent of the use of the hot water.

IV. CONCLUSION

The experimental study of two times of the heat storage refrigeration system with waste heat recovery two times, the single regenerative heating and the heating operation mode can be used to show that the system can be used to heat the heat of the condenser, and combine with the heating water supply system to produce the required temperature or industrial water.By analyzing the performance parameters of the system, it can make the system more efficient and more convenient. Compared with the traditional system, the system is more in line with the requirements of energy and environment, follow the path of green development.

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