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PROSPECTS OF INTRODUCTION OF AN ENERGY SAVING VACUUM RADIATOR IN SYSTEMS OF A HEAT SUPPLY OF HOUSING AND COMMUNAL SERVICES

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In article the urgency of use innovative technologies of energy saving in systems of a heat supply of residential buildings and industrial constructions by means of electric vacuum radiators with the effective heat-carrier is proved. Structurally this (offered) device of heating is executed as a usual oil radiator. Difference that in it warm water doesn't proceed, and is created vacuum and the effective heat-carrier (thermal reagent on the basis of essential oils) which heats up elektroteny in capacity of 300 W. The purpose of introduction independent automatic the energy saving vacuum radiator with the effective heat-carrier in heat supply systems, is possibility considerably to reduce energy consumption for heating of premises. Simple mathematical calculation allows to prove economic advantages of use of this development.

Keywords: heating system, electric vacuum cooler, energy saving, heat transfer, thermal reagent, heat-carrier

Introduction

Urgency of a problem of energy saving, profitability and ensuring rational work of heat power systems of the cities and as their reliability throughout all term of operation is dictated by the priority directions of development of RK and the world community as a whole. The solution of this task consists in development and introduction of the devices allowing essentially to reduce power expenses and to optimize working hours of thermal system. The prospect of the scientific directions in the energy sector of economy of RK depends today on real application of results of scientific researches and approbation in practice. In this regard it is necessary to notice that one of the actual directions is application of hi-tech, low-power-intensive, energy saving systems of a heat supply by high economic effect.

High power consumption of the Kazakhstan economics is caused by a number of factors, among which the weakest account, control and expenditure regulation energy resources in all spheres, artificially underestimated tariffs for the electric power and the prices for other energy carriers, lack of interest of power consumers in rational use and an economical expenditure of the energy resources, almost total absence of national production of the power effective equipment, prevalence of exclusive system of power supply and some other were main. In recent years specific power consumption increased even because of under loading or idle time of the industrial enterprises.

High power consumption and non-productive costs of energy caused decrease in an export potential of fuel and energy complex of Kazakhstan at least on 100 million tons of equivalent fuel, competitiveness of a domestic production approximately for 10-15 % decreased. Power wastefulness in all spheres of production and a life causes of additional production of fuel and energy resources in volume not less than 170 million tons of equivalent fuel. At industrial output restoration at level of 1990 it is required to the country in addition not less than 300-350 million tons of equivalent fuel, which production is absolutely unreal. By calculations it is proved that for production maintenance at level of today expenses at a rate of 65 bln. dollars USA, while are necessary for ensuring economy 100 million tons of equivalent fuel 5 bln. dollars USA are necessary only. Proceeding growth of power consumption is caused by increase in expenses of the state budget at the contents and a fuel supply of the social sphere, compensation of a part of utility

bills of the population and the social tension connected with it. Growth of power consumption of an industrial output leads to decrease in competitiveness of domestic producers.

Growth of consumption of energy resources is interfaced to the environmental problem directly connected with environmental pollution and exhaustion of mineral resources. There is an urgent need of reduction of emissions of CO2. When ignoring these circumstances the mankind can appear on a threshold of a global disaster. To avoid possible consequences it is necessary to pay attention to development of energy saving technologies and their use in the power sphere. It will allow providing the solution of important scientific problems of optimum and rational power consumption, and in practice to realize a principle of reduction of losses of energy by its production, transportation and in the course of consumption. It is more rational to reduce loss of one kilowatt at an o'clock of the developed energy, than it to develop, especially this circumstance concerns systems of a heat supply of the cities and settlements.

Taking into account the aforesaid, there is a need for creation of the new concept at creation of systems of the heat supply allowing considerably to reduce power consumption. The vacuum energy saving radiator with the effective heat-carrier (thermal reagent on the basis of essential oils) can become a link of this system. Work of an energy saving vacuum radiator (EVR) is based on use of internal energy of steam the effective heat-carrier which has been made active by a warm surface by an electric heater that allows to provide necessary heat technical parameters at the minimum expenses of the electric power. A main objective of introduction of independent automatic EVR with the effective heat-carrier in heat supply systems, is possibility considerably to reduce energy consumption for heating of premises. The offered energy saving radiator at the same working heat technical parameters consumes 300 W. Structurally electric energy saving radiator is similar to water radiators of heating in which internal cavity the vacuum (10-2 Torr) is created, for activation of the effective heat-carrier the electric heater in capacity of 300 W that is quite enough for its activation and effective heat transfer is used. It would be desirable to note the following important circumstance that EVR completely automated and doesn't demand manual control, temperature control in a room and in EVR is carried out by means of the built-in semi-conductor temperature relay.

Use of new high technologies will allow to increase system efficiency, to increase its efficiency and to reduce losses, at the expense of use of independent electric vacuum radiators. The vacuum radiator ideal replacement to a traditional radiator, it can work from an electric network, without system of pipelines. The traditional water system of heating has three main minuses: air jams, metal corrosion, low efficiency of transfer of high temperature, a vacuum highly effective radiator can perfectly solve these problems. The electric heating element is at the plate basis, high temperature of the heat-carrier heats up easy to highly volatile liquid which evaporates, and steam rises up in top of each vacuum column, transferring high temperature from the basis to top. It reaches fast effect of heating of each radiator. While in usual system of heating water temperature +50-80C. Water makes a long way through each column in each radiator in system. It takes long time of heating of all system, and a large amount of water is required. In a vacuum radiator of these problems isn't present. easy to highly volatile liquid starts to evaporate at temperature +35C, and works in each independent column. With such vacuum radiators the system heats up much quicker, than traditional and the volume of the heat-carrier is required much less. But at fast heating of system, it also quickly cools down. Besides the specified advantages, the vacuum energy saving radiator consumes capacity, it is much less than traditional, and also has no the shortcomings connected with circulation of the heat-carrier on system of pipelines that considerably reduces the price of its operation. The single-phase electric network is necessary for work of EVR with tension 220V.

EVR of heating is constructive is executed as a usual radiator of heating, but in his cavity, warm water doesn't proceed, and the vacuum is created and the effective heat-carrier which has been made active by an electric heater is placed. Appearance and a design of the studied prototype of an energy saving radiator of heating are given on drawing 1.

For increase of overall performance of EVR it is equipped with the external and internal temperature sensors connected to the thermal relay. This constructive decision allows to carry out control of temperature of heating of working surfaces of EVR on external and internal thermal parameters and provides an economic operating mode of the device.

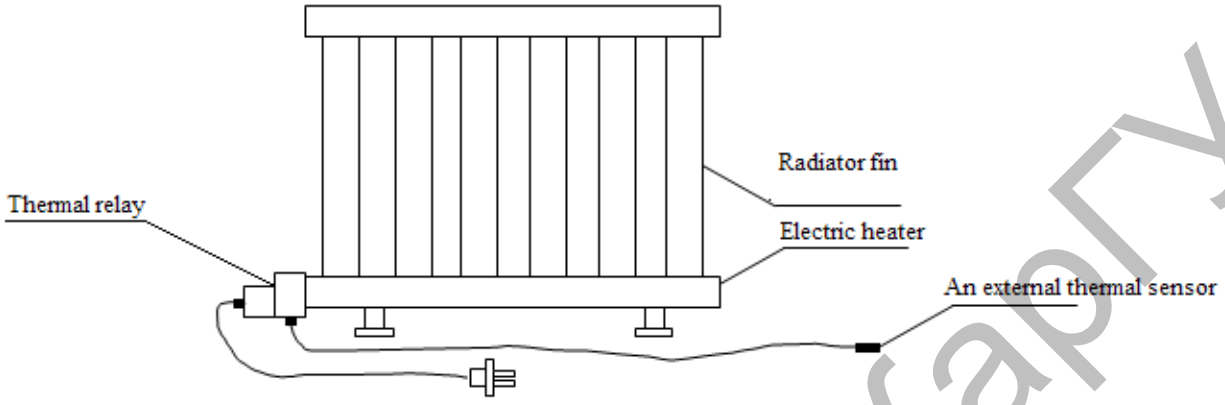

Fig. 1. The energy saving radiator

The external temperature sensor provides temperature control indoors and doesn't allow unnecessary work at normal intra room temperature, and internal supervises heating of the heat-carrier and doesn't allow its overheat. Thus the working temperature of surfaces of heating of EVR doesn't exceed admissible 80 C, but remains ability to warm with one section of a radiator of the 2nd sq.m of premises at electric power expenses to 0,05 kW in hour. It would be desirable to note some positive factors raising indicators of reliability of work of EVR. This absence: circulating under the pressure of working liquid; rigid binding to system of pipelines. Important factors are: almost zero probability of wear of a flowing part and leak emergence; lack of mobile and rotating parts, the circulating pump. The approximate resource of work of this system makes about 15-20 years without refueling. All these circumstances allow to develop completely automated intellectual system with low power consumption and high overall performance.

The closest on technical essence and reached result is the lithium radiator of bromide which can work at various sources of high temperature, type: an electricity, gas, a copper, the furnace, a solar water heater etc. in which hot water only runs in a pipe at the plate basis, and high temperature of hot water changes lithium liquid of bromide.

Despite high technical and economic indicators Lithium Radiators of Bromide, are available also some shortcomings one of which is that a power source are solar batteries which are now expensive and don't provide with sufficient energy in cloudy weather and night time, in addition for heating of radiators use working liquid that in turn demands reliable sealing of radiators and doesn't provide independent installation of heaters and demands considerable costs of installation.

Advantages of vacuum radiators of heating before traditional radiators:

– Lack of air jams in heating radiators;
– Vacuum radiators of heating aren't subject to corrosion;
– Lack of technical water in heating system;
– Economy of energy resources more than in 2 times on energy consumption;
– Simplicity of installation - in comparison with a traditional water heat supply;
– Long term of the operation, more than 20 years;
– Exception of a contamination of a flowing part of radiators;

– Safe - vacuum radiators of heating correspond to all standards and requirements of state standard of 31311-2005 items 5.2,5.9 of the Republic of Kazakhstan.

With vacuum radiators the system heats up much quicker, than traditional and volume of the heat-carrier it is required much less: the substance being in a radiator starts to allocate heat at temperature from +25C. Warmly immediately fills each section of a vacuum radiator, transferring without changes heat-carrier temperature on all volume of a vacuum radiator of heating. It reaches fast effect of heating of each section of a radiator.

The carried-out numerous researches of the EVR working parameters allowed to reach efficiency of technical indicators of its work, to optimize a form and an electric heater design with a heat chamber, convective channels of a surface of heating, an internal cavity of an edge, and as a chemical formula of the heat-carrier. The best result of work of EVR is reached at vacuum existence in his internal cavity, speed of a set of working temperature, uniformity of heating of convective surfaces of EVR and absence of noise that the comfort condition is important at its operation thus increases.

In the course of research the factor directly influencing a resource of operation of the effective heat-carrier is established. The increase in temperature from 100 C to 150 C leads to reduction of its resource approximately three times, and at temperature 200 0C it can make about 600 hours. Energy saving radiators of heating have considerable service life and meet all requirements and standards of state standard specification of 31311 RK from 2005 year. The made experiments showed that the set of necessary temperature 80 0C, can be provided at capacity of an electric heater of 200 W, naturally speed of warming up of a surface of a radiator taking into account violation of vacuum increases at increase of electric capacity to 300 W. Results of researches are presented by schedules of dependence of heating of surfaces of a radiator from time at tension of an electric heater 200-240 V(drawing 2). At present time the experimental sample of an energy saving radiator working from a single-phase electric network, with power consumption of 200 W is developed.

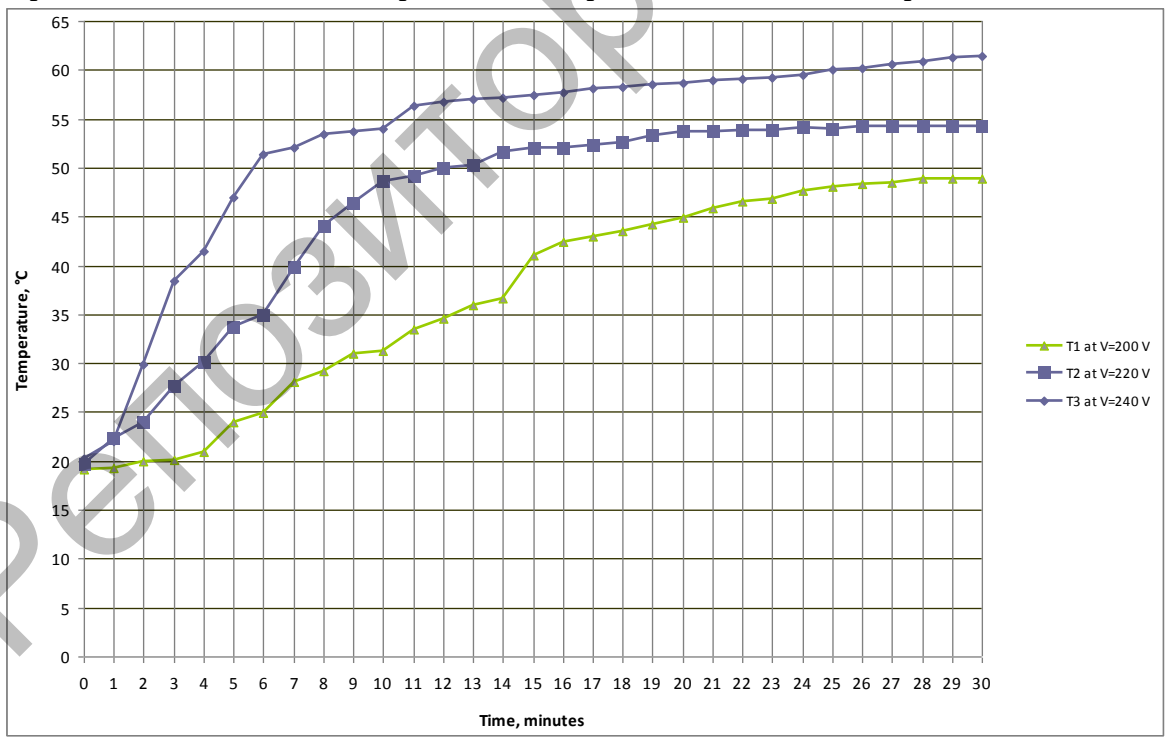

Fig.2. Dependence of heating of surfaces of a radiator on time at tension of an electric heater from 200 to 230 V with identical indicators of vacuum

Economic effect consists in low power consumption of EVR, namely in activation of the effective heat-carrier and obtaining warmth at the expense of allocation of internal energy of substance. The traditional radiator consisting of 7 sections, without losses of pipelines and the energy expenses, spent in the pumps providing circulation, consumes about 1 kW. Offered EVR is capable to provide the same heat technical parameters at power consumption about 300 W. Huge advantage of this technology consists in simplicity of installation, operation, the high reliability full of an autonomy and independence of sources of thermal energy.

Important factors are: almost zero probability of wear of a flowing part and leak emergence; lack of mobile and rotating parts, the circulating pump. The approximate resource of work of this system makes about 15-20 years without refueling. All these circumstances allow to develop completely automated intellectual system with low power consumption and high overall performance.

Simple mathematical calculation allows to prove economic advantages from use of this development, for example costs of heating of the two-room apartment in the city of Karaganda for 2011 year in living space 46 sq.m make about 3500 tenges, and upon transition to heating with use of three energy saving radiators makes 2500 tenges. The difference quite essential, thus cost of an energy saving radiator from 10 sections approximately makes 15 thousand tenges.

On the basis of the moved experiments it is possible to judge that low power consumption of EVR allows to lay the foundation for essentially new concept of development of highly effective electric systems of a heat supply of buildings and constructions of the cities without use of warm water circulating on pipelines. That leads to considerable losses of heat through their walls, corrosion and a contamination of a flowing part of pipes, to formation of air jams and need of a purge before system start. Perspective there is a direction of use of this radiator together with solar and storage batteries.

The carried-out researches showed high efficiency, low power consumption, reliability and safety of work of EVR. Proceeds work on EVR improvement that will allow to use an electric heater in capacity 300 W, capable to provide demanded heat technical parameters with the greatest resource of operation of the effective heat-carrier.

Use of results of researches will allow to establish optimum heat technical parameters of an electric vacuum energy saving radiator and to create the methods allowing cardinally to improve overall performance of systems of a heat supply of housing and communal services. This technology allows to provide effective functioning of systems of a heat supply of objects of housing and communal services, without system of pipelines with the heat-carrier circulating on them and possible situations of its leak, and also to exclude costs of the electric power of operation of pumps with the power-intensive drives, providing heat-carrier circulation in system and maintenance of its working parameters. The electric vacuum energy saving radiator is completely automated and independent system, has high reliability in long term of operation and exceeds known traditional radiators of heating on the economic parameters.

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