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THE DEVELOPMENT OF MATHEMATICAL MODEL FOR CONTROL AND MANAGEMENT OF AUTONOMOUS APARTMENT ENERGY SUPPLY COMBINED SYSTEMS

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РОЗРОБКА МАТЕМАТИЧНОЇ МОДЕЛІ ДЛЯ КОНТРОЛЮ І УПРАВЛІННЯ ПОЄДНАНИХ СИСТЕМ ЕНЕРГОПОСТАЧАННЯ АВТОНОМНОГО ПРИМІЩЕННЯ

Асманкіна А.А., Королевський С.І., Лорія М.Г., Целіщев О.Б., Жидков А.Б.

The all modern developments purpose is production inputs an improvement and diminishing. Tariffs increase is one of main modern Ukraine problems, therefore there is a necessity for the energyindependent, autonomous systems creation which will be controlled and managed remotely. The combined systems creation, able to work remotely and regardless of direct energy resorses, will result in the considerable protected level increase from tempreture overfalls and overfalls in the electric system instability . Sensors presence in this system allows to control, regulate and signal about its state, and similarly, enables to set necessary parameters. The mathematical model creation will allow remote control and management of all room systems.

Keywords: *combined, system, control, economical, independent, mathematical model, system, heat pump, temperature*

Introduction. All types basic energy and power users mediums are enterprises, and necessary part of any enterprise is it's energyeconomy. It is an aggregate of the generating, transforming, transmitter and consuming power settings by means which providing all necessary enterprise types of energy and use it to carry out in the production process. In addition, an energyeconomy plugs in itself devices and automatic control systems with their informative providing, not power settings, buildings and resources, providing reliable and economical enterprise energy work, and also lighting, heating and fuel supply. An enterprise energyeconomy is not only an auxiliary and attendant production but also basis, providing the normal enterprise functioning. [1]

Problem raising. Users presence (small cities, settlements), being in districts, isolated from existent grids, or provided with electric power, for diverse reasons, with interruptions, require autonomous energy supplien organization. [2,3] Development actuality and creation of electric power autonomous users energy supply perspective sources is a long ago acknowledged in many industrial-developed countries. Fossil energy sources supplies narrow-mindedness, and also situation folded presently with a price advance on a hydrocarbon fuel, along with ecological situation intensifying, are factors, by a stimulant introduction and renewable use of natural resources in the electric energy production field.[4] Autonomous energy problems actuality in our country and its developed abroad determine the research-and-developments necessity in regard to the systems, providing an independent energy supply with the receipt effective facilities use, electric power accumulation and transformation. [5] In addition to the users in remote districts, business enterprises and some private communal structures, nevertheless, having connection with general grid, interested in the cheap sources use reserve energy feeds which will provide by it more flexible dependence on the energy supply existent system. To save resources, we need remote control and adjustment of the system's indicators, what is why we need to create a mathematical model.

Analysis of recent research and publications. The actuality of the problems of the autonomous energy security in our region and in the future is rooted beyond the cordon, it is important to maintain the safety and security of the schodosystems, to ensure that the emergency services are not withdrawn from the emergency services, the funds are collected, the money is saved and the electricity is removed.

A known invention relates to equipment for the residential and industrial buildings heating. Compressive heat pump contains evaporator, compressor, condenser, throttle valve and liquid separator. [6] The evaporator and the condenser are made in the form of shell-vortex heat exchangers containing the supply and discharge pipes of the working agent and the supply and discharge pipes, respectively, the low-potential coolant and the high-capacity coolant, the collector with the guide apparatus and end walls, on the inner and outer

surfaces of which the channels are executed, and the casing is mounted on the outside.

Different techniques are used to improve the thermal energy transformation efficiency. For example, in the method of achieving the maximum heating heat pump coefficient according to the patent [7], the heat pump refrigerant agent is chosen to be liquid so that its critical temperature is close or equal to the cooled medium temperature. A well-known heat supply method, which includes the water supply for heating in a heat pump installation system, heating water with its help and delivery of heated water to consumers. The heat pump installation consists of heat pumps, each of which is used as a successive level water heating. [8]

A known device [9], in which the insert, made in the form of a perforated partition, installed in the injection nozzle, is additionally used to raise the temperature of the liquid. When the liquid passes through the channels of the septum in the fluid, toroidal cavities (cavitation bubbles), pulsating at the outlet of the jets along their periphery, are formed. In cavities with a high frequency there are electrical discharges, the energy of "collapse" cavern goes into heat, due to which the heat generation in the liquid occurs. Lack is the absence of cavitation in the entire volume.

Works purpose. The purpose of the article, the solution of which is directed to the invention, is to develop a mathematical model of the heat exchange unit with a heat pump, which provides an increased thermal coefficient by reducing the power consumption for compressing the working fluid in the heat pump working cavities, as well as by using the second level of the hydrodynamic device.

Main content. The cavitation efficiency and degree increase coolant is arrived at by process intensification on the phases section border due to liquid stream co-operation kinetic energy and cumulative effect slam of strings. In the bubble disappearance moment (in the moment of his slamming) kinetic energy will be transformed in elementary particles collision energy. Energy, selected at bubble slamming on a few orders exceeds elementary particles (nucleons) connection energy in a kernel. As a declared method kernels collision result energy, selected between elementary particles, will be transformed in thermal energy in a liquid and it is taken from an area by treatments of hydrodynamic kvitation reactor.

On fig.1 a hydrodynamic cavitation reactor is schematically represented.

A reactor contains: union coupling of input 1 second coolant stream; lid 2; running chamber 3; cylinder 4; reverse cut cones 5; cavities slam 6; nozzle 7; dissecting 8; dividing perforated partition 9, which sinews for dissecting; diffuzor 10; union total coolant stream conclusion coupling 11, consisting of the first and second streams; union coupling of input the first collant stream 12. Now about streams: heated coolant on a tube 8 circulation pump 5 gives on a delimiter 9, in which the first stream is sent in the union coupling 12, and the second stream is sent in the union coupling 1.

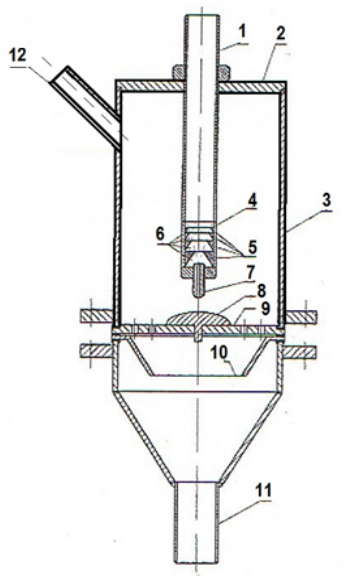

Fig. 1. Hydrodynamic cavitation reactor

A hydrodynamic cavitation reactor works as follows. First stream on the union coupling 1 given in a cylinder 4, where the reverse are set cut cones 5, which the horizontal and sloping surfaces are form slam «cavities» 6. The horizontal surfaces of the cut cones execute the brake element role as circular ledges, at flowing around of which n cavitation cavities appear (cavities). The heated stream is given forcedly in «cavities» and, getting in the closing them areas due to the turbulization of flow and cumulativ microstructures e plenty presence, appearing at slamcavitative bubbles, exposed to enhanceable temperatures formation.

Thus, formed conical surfaces, attachments are provided by the nozzle «second» high-speed stream appearance terms 7.

At some distance from the butt-end nozzle surface 7, hollow cone liquid stream shell at a speed of v_0 slams and the second high-speed stream appears by a radius r_0 . In slamming moment working stream environment the second high-speed stream speed v_c increases approximately on an order in relation to speed v_0, that follows from the hydrodynamic stream theory. [10]

Further the second high-speed stream heads for dissecting 8. It was paid regard to streams hitting place flat-back and appearance so-called «wings» - structures, reminding the arrow plumage is set. Power more expedient is hitting realization with a curvilinear surface and achievement high navigation level. In addition got coolant mixture the first and second streams pass a dividing partition 9, pass diffuzor 10 and hatch through the union coupling 11. Heat-exchange efficiency ability on-the-spot shallow drops increases yet and the Tompsons effect– surface-tension forces influence.

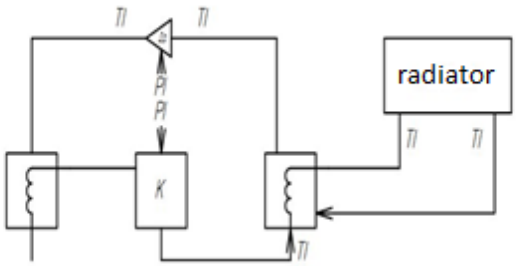

Fig. 2. Trial laboratory setting

For the leadthrough of alpha tests setting which consists of compressor K, batteries, was developed, throttle Dr, temperature sensors systems Ti and pressductors PI. For liquid motion on pipes a pump is foreseen on the laboratory setting entrance. Water, entering setting passing through a compressor, where a compression and coolagent steams moving is, as in the refrigeration settings. At the steams compression there is not only pressure increase but also temperature. After a compressor the compressed refrigeration agent enters condenser, where the compressed gas cools down and grows into a liquid, a liquid after through a choke device enters vaporizer (its pressure and temperature goes down thus), where it boils, passes to the gas state, the same taking away warmly from surrounding space. After it the coolagent pair enter again compressor for the cycle reiteration. Thus, on an output water will have a temperature much higher, than on an entrance, what provides radiator heating. The liquid further used and reducing a temperature passes through a throttle, for hydraulic resistance creation the liquid stream. Additional hydraulic resistance is created due to the liquid stream communicating section change. The hydraulic resistance change is create the necessary pressures overfall, that results in the yet greater stream temperature decline.

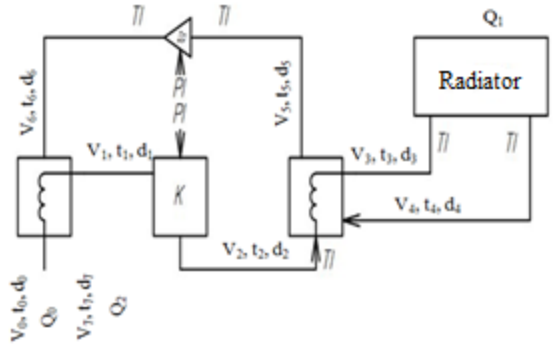

Fig. 3. Parameters for constructing a mathematical model, where V is the volume of the liquid, t is the temperature indicator, d is the diameter of the hole, Q is the amount of heat

Modern European and Scandinavian countries have advanced very far in the development and application of alternative energy sources. The expansion of theat supply systems use in Ukraine based on heat pumps with ground heat exchangers is not sufficiently high, however, in the face of a sharper deficit and rising energy prices, the energy saving issue for the Ukrainian economy as a whole and for its housing and communal sector in particular becomes very relevant.

Conclusion. The strong side of this research is the positive effect obtained from reducing the energy load on the compressor. The same decrease in the throttle losses of working heat in the heat pump circuits is achieved at medium condensation temperatures. The increase in the thermal coefficient of the whole installation takes place in the hydrodynamic cavitation reactor, which is considered by the second power plant, which is very important for heating houses, cottages and, in particular, for preheating and improving the rheological properties of oil and petroleum products [11]. The weak side of the research is the collection of results for the further development of the mathematical model of the heating installation. To assess the adequacy of a mathematical model, the collection of readings from sensors is performed depending on the temperature characteristics of the external environment, which requires more detailed observations depending on the time of year and the desired temperature in the room.

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Асманкіна А.А., Королівський С.І., Лорія М.Г., Целищев А.Б., Жидков А.Б. Розробка математичної моделі для контролю та управління об'єднаних сі-стем автономного енергозабезпечення приміщення.

Актуальність розробки і створення перспективних джерел енергопостачання автономних споживачів електроенергії давно визнана в багатьох промислово розвинених країнах. Обмеженість запасів викопних джерел енергії, а також що склалася в даний час ситуація з ростом цін на вуглеводневе паливо, поряд із загостренням екологічної обстановки, є факторами, що стимулюють впровадження і використання поновлюваних природних ресурсів в сфері виробництва електричної енергії. Створення комбінованих систем, здатних працювати дистанційно і незалежно від прямих енергоресурсів, призведе до значного підвищення рівня захищеності від нестабільності температурних перепадів і перепадів в електричній мережі. Наявність датчиків в цій системі дозволяє контролювати, регулювати і сигналізувати про її стан, а також дозволяє встановлювати необхідні параметри для побудови математичної моделі.

Ключові слова: *система управління, економічна, незалежна, математична модель, система, тепловий насос, температура*

Асманкина А.А., Королевский С.И., Лория М.Г., Целищев А.Б., Жидков А.Б. Разработка математической модели для контроля и управления объединенных систем автономного энергоснабжения помещения.

Актуальность разработки и создания перспективных источников энергоснабжения автономных потребителей электроэнергии давно признана во многих промышленно-развитых странах. Ограниченность запасов ископаемых источников энергии, а также сложившаяся в настоящее время ситуация с ростом цен на углеводородное топливо, наряду с обострением экологической обстановки, являются факторами, стимулирующими внедрение и использование возобновляемых природных ресурсов в сфере производства электрической энергии. Создание комбинированных систем, способных работать дистанционно и независимо от прямых энергоресурсов, приведет к значительному повышению уровня защищенности от нестабильности темпиратурных перепадов и перепадов в электрической сети. Наличие датчиков в этой системе позволяет контролировать, регулировать и сигнализировать о ее состоянии, а также позволяет устанавливать необходимые параметры для построения математической модели.

Ключевые слова: *система управления, экономичная, независимая, математическая модель, система, тепловой насос, температура*

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