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COMBINED HEAT SUPPLY SYSTEM FOR BUILDINGS AND STRUCTURES

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Abstract. The abstract discusses the inefficiency of solar heat supply systems in cold seasons and proposes combined systems using additional energy sources for optimized performance. The paper analyzes various configurations and their energy-saving potential.
Keywords: combined heat supply, solar collectors, seasonal storage, energy efficiency, heating, hot water supply, renewable energy.

Introduction. The topicality of the study lies in the need to increase energy efficiency in building heat supply systems while transitioning away from fossil fuels. The object of research is combined solar and auxiliary heat supply systems. The subject is the structural and functional characteristics of such systems. The goal is to identify optimal configurations for year-round efficient energy use. The novelty lies in proposing integrated systems that balance solar and backup energy sources for both heating and hot water.

Text

The intensity of solar radiation during the winter period, and in some cases in the spring and autumn, is insufficient to provide the required power of solar collector heat supply systems. To cover loads during these periods, a high-capacity seasonal solar energy storage is required. However, the installation of such a storage system significantly increases the cost and payback period of solar systems. Therefore, such storage units have not become widely adopted [1].

In such cases, it is advisable to equip these systems with additional energy sources – electric boilers or boilers running on fossil fuels. Given current trends aimed at reducing overall energy consumption and phasing out the use of fossil fuels, the use of additional energy sources that minimize specific energy costs for heating the heat carrier and are environmentally friendly becomes relevant.

To utilize the energy potential of the heat carrier obtained in solar collectors, a dual-circuit system with forced circulation is recommended for heating and hot water supply. The first circuit includes a block of solar collectors, a circulation pump, and an expansion tank to compensate for the thermal expansion of the heat carrier. The second circuit, where network water circulates, consists of an accumulator tank and an additional electric water heater.

For solar systems serving a large number of consumers, systems with two parallel-connected accumulators are advisable. In the first tank, the heat carrier is preheated using solar energy, and in the second, it is further heated using conventional heat sources (electric heater) [2]. Both accumulators are connected by a circulation pipeline. When solar energy intensity is high, the use of additional energy sources is unnecessary.

If solar systems are used simultaneously for heating and hot water supply, two separate thermal storage tanks are used – one for the water supply system and the other for the heating system. The advantage of such schemes is the ability to use heat carriers in the first circuit that do not freeze at low temperatures. If necessary, a combined scheme may be proposed, combining a solar water heating unit and a heat backup – a fuel hot water boiler using pellets or other types of organic fuels as the energy source. This setup allows preheating of the feed water entering the boiler using solar energy. The control unit coordinates the power of energy sources with the thermal loads of the system.

Conclusions. Combined systems offer a viable alternative to fully solar systems by compensating for seasonal inefficiencies and reducing fossil fuel dependence. Optimized configurations provide environmentally friendly and cost-effective heat supply solutions.

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ANALYSIS OF RESEARCH METHODS AND APPLICATIONS OF HYDROMECHANICAL TRANSMISSIONS IN MILITARY VEHICLES

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Abstract. Modern methods of analysis and design of hydromechanical transmissions for vehicles, especially for military purposes, have been studied. Their advantages, disadvantages, and operational factors are identified. A methodological "chain" of design research stages has been formed to substantiate progressive technical solutions in this field.
Keywords: hydromechanical transmissions, hydro-volumetric transmissions, vehicles, design research, operational factors, cavitation, mathematical modeling.

Introduction

Topicality. In the current context of vehicle modernization, especially for military purposes, the choice of transmission type with optimal characteristics is critically important. Hydromechanical transmissions demonstrate significant advantages, but their implementation requires detailed analysis of design features and operational factors.

The object of the research is the processes occurring in hydromechanical transmissions of vehicles.

The subject of the research is the methods of design and research of hydro-volumetric mechanical transmissions.

The goal of the work is to analyze modern research methods and areas of application of hydromechanical transmissions.

The tasks of the study include:

5. Determining the advantages and disadvantages of hydro-volumetric transmissions compared to mechanical ones.
6. Analysis of operational factors affecting reliability.
7. Research of design and modeling methods.
8. Formation of sequential research stages to substantiate progressive technical solutions.