ENERGY-SAVING HEAT- REFRIGERATION SYSTEM ON LIVESTOCK FARMS

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Creating heat- refrigeration systems (HRS) on livestock farms is due to the requirements of the sustainable use of natural resources, heat, cold, and in the production of electricity, cooling and storage of milk, sanitized equipment, watering livestock and performing other very energy-intensive operations.

The purpose of research - development of energy-saving heat- refrigeration systems (HRS) that reduce operating costs and improve efficiency of milk production on livestock farms.

Materials and methods of research. To reduce operating costs and energy efficiency of milk production on livestock farms, it is advisable to install TCS, which must satisfy the following conditions.

1. To provide the most favorable interaction flow of heat, cold and electricity.

2. Comply with the system of machines and technologies adopted in this cattle farm.

3. The most rational use of natural sources of heat and cold, such as regenerative energy of the cooled product, natural cold air, ground water.

4. Widely used water recycling maintaining the hydrological regime and ecological status of groundwater.

5. The stored energy of heat and cold to work effectively during the preferential electricity tariff, reducing the installed capacity and the cost of equipment.

6. The equipment used must meet the conditions of use on farms and do not require special training.

The results of research. To justify a balanced supply of heating and cooling of livestock farms in the GNU VIESH developed a mathematical model and method of calculating the parameters of the two types of heat- refrigeration systems: using natural cold groundwater and two-section heat exchangers for pre-cooling of milk, and using combined heat- refrigeration machines used for balanced heat - and cooling systems on farms as using artificial and natural sources of heat and cold.

The proposed method of calculating the energy saving heat- refrigeration systems based on a comparative analysis of the energy balance of these systems in different variants of the installation and use on livestock farms in the central region of the country. Main options were considered energy efficient cooling of milk to the accumulation of heat and cold: the utilization of low-grade heat-cooled product (milk); by heating air and water for technological needs; when using natural cold batteries combined-heat exchangers air-water indoor and outdoor installation.

Conducting the tests found that the use of natural cold outside air or ground water allows you to fully or partially cooled milk the natural environment, and in the northern regions of the country all year round and at the same time to recover the energy that is useless discharged into the environment. For these purposes, the composition can be used TLC refrigerating machines of various types vapor compression (mechanical energy); absorption (heat energy); thermometers (electricity) and others.

The most promising at this stage in the manufacture of so-called were moderate cold vapor compression chillers. For TLC on livestock farms tested machines of this type. Heat transfer between the heat transfer fluids directly through the dividing wall. For heating and cooling, gas and liquids in the evaporator and condenser used a specially designed heat exchangers.

In tests of TCS in the farms as heat exchangers heat exchangers used in the main flow type.

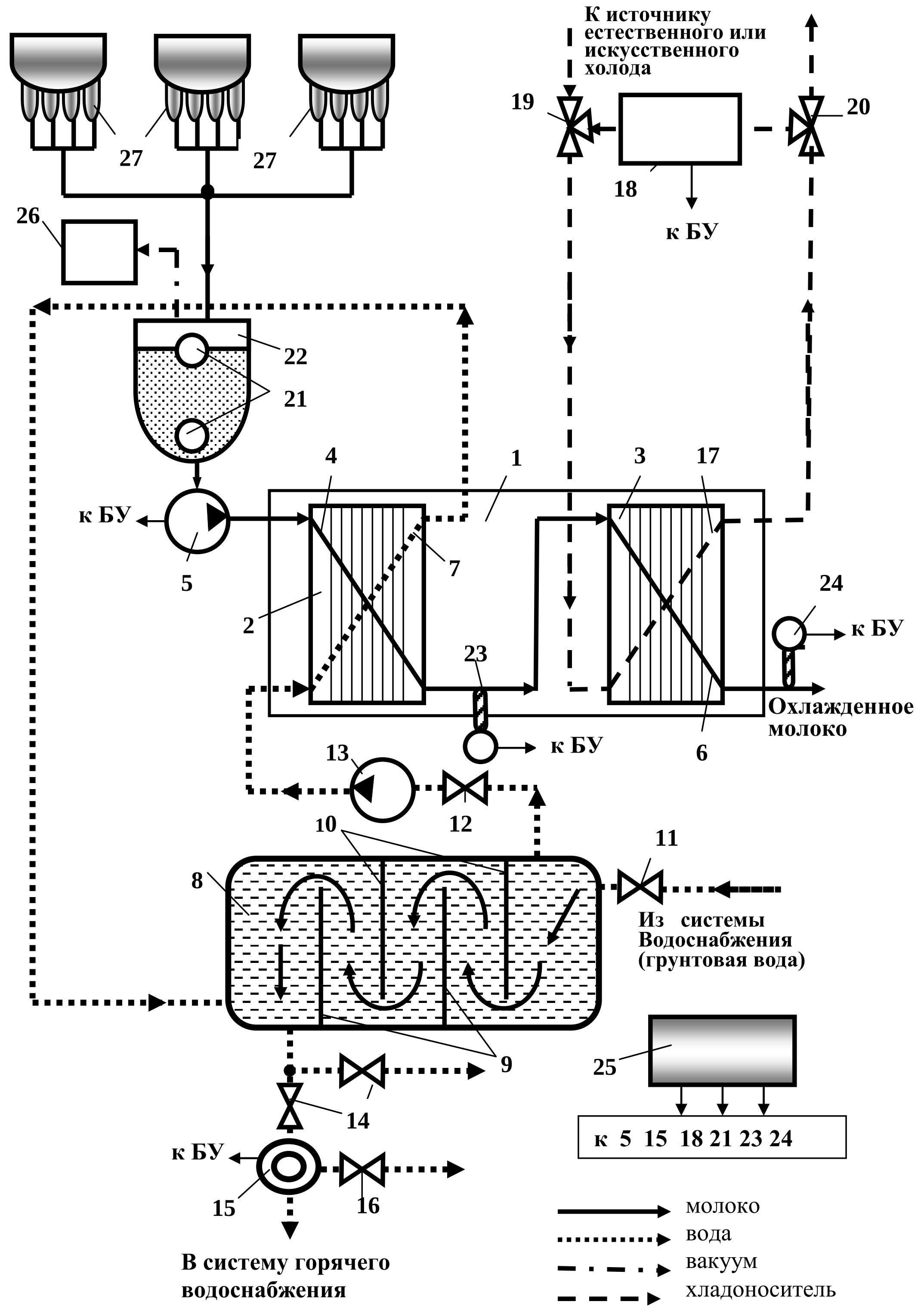
Diagram of one embodiment of TCS, developed in GNU VIESH RAAS, shown in Fig.

Heat- refrigeration installation for farm operates as follows.

Releaser 22 is evacuated with a vacuum pump 26 and the milk from the milking machine 27 gets into it. Level sensors 21 and include sequentially disables universal milk pump 5 when the milk level sensor level releaser 22. Milk pump 5 is supplied to the milk channel 4 of the first section 2 of the heat exchanger 1, and then the milk channel of the second section 6 of the heat exchanger 1. Thus 3 , the milk to the milk channels 4 and 6 of the first 2 and 3 of the second section of the heat exchanger 1 moves discretely "pulses". Sealed tank 8 through the valve 11 is filled with water from the water supply system in the farm. Since the control unit 25 in synchronism with the milk pump 5 includes a pump for a coolant (water) 13 and cold water through the valve 12 enters the channel 7 for coolant heat exchanger 2 the first section 1 and returned via line into the lower, outer section of the sealed container 8, the side wall formed this reservoir and thermally insulated partition group insulated walls 9. border hot and cold coolant rises as the coolant pump in the section goes over the edge of the partition in the next section will be lowered in this section, then pass under the lower edge of the heat-insulated walls 10 and into the next section so on until the hot water does not fill the tank 8. But at this time and in the period between milkings heated water at the bottom of the section will be at the valves 14 and 16 spent on household and industrial needs: for watering animals, undermining the udder washing process equipment , sanitization and others.

Reheating to a high water level is performed using a thermal door closer 15. Thus, the cold water coming from the sources of water used for pre-cooling the milk, and the thermal energy recovery. Final cooling of milk produced in the second section 3 of the heat exchanger 1. The milk flowing through the channel 6 the milk is cooled by a coolant (ice-water) flowing through the passageway 17. The cooled coolant flows into the refrigerant channel of the receiver natural cold accumulator.

Connecting a source of cold taps carried out 19 and 20 from the control unit 25 temperature sensor signals 23 and 24. Since the installation of the proposed type heat-refrigeration closers 18 mounted cooling capacity does not exceed 18, 25 ... 30% of the rated capacity of the refrigeration unit according to the traditional technology, the as the closer - the cooler 18 can be used during the warmer months much more reliable source of cold, such as vapor compression refrigeration system with hermetic compressor or thermoelectric battery of high reliability, working on the Peltier effect.



Heat- refrigeration setting for farms:

1 - heat exchanger; 2, 3 - a heat exchanger; 4, 6, - an inlet channel for the milk; 5 - milk pump; 7 - channel for the coolant; 8 - sealed tank; 9, 10 - a group of partitions; 11, 12, 14, 16 - valve; 13 - pump; 15 - Heat closer; 17 - channel for the

coolant; 18 - Water-cooled coils; 19, 20 - switching valves 21 - level sensors; 22 - releaser; 23, 24 - the temperature sensors; 25 - control unit; 26 - vacuum pump; 27 - milking machines.

Conclusions

Tests have shown that the use of plants for farms heat- refrigeration proposed type saves 25 ... 30 % of the electricity, reduces capital and operating costs, improve system reliability. For example, when the capacity of the reservoir of ice water equal to one ton, 300 kg of milk obtained during a milking, can be cooled to 15 ° C even in the preliminary stage. In the cold to cool milk 1 t need no more than 3 kW · h / t, while the traditional cooling applied on farms cooling systems specific energy consumption per 1 ton of milk is 28 ... 30 kW · h / t. In this regenerated energy to heat water for technological needs of the farm.