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# ALGORITHM FOR MONITORING THE TOTAL AMOUNT OF DAIRY PRODUCTS IN FARMS

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**Abstract**
This article describes the technological process of milking-on-milking farms. The current state and level of process automation is analyzed. As a result of the analysis, a project structure was proposed to improve the technological process of milking. According to the project, a system control algorithm was developed, as a result of which it was stated that it is possible to automatically monitor the amount of milk being milked in farms.

**Keywords**. Milk products, milking, mastitis, automatic monitoring.

## Introduction

It is known that milk and milk products are very important in people's daily life. Milk is very useful for human health. The immune system of the human body is strengthened by consuming natural, clean dairy products. Most of the milk in the world is milked from cows, so much attention is paid to breeding and feeding cows. The growth of the world's population increases the demand for milk and milk products. Currently, cows are being fed and milked on farms. The large number of cows creates the problem of quick and high-quality milking. In many modern farms, cows are milked on special machines, however, it is necessary to monitor the milking process and the machine.

Machine milking increases labor productivity several times, but imposes particularly strict requirements on compliance with the technological regime. Thus, with a decrease in vacuum, cows may not be fully milked, and with an increase in vacuum, the risk of mastitis increases. The process itself is not simple and requires proper attention to detail, neglecting which can lead to bad consequences in the end. When making a decision on the organization of machine milking of cows, the method of keeping animals and the size of farms are taken into account. Depending on this, the process can be organized using different milking machines. The number of machines a milking operator works on a machine depends on the type of milking machine, the level of productivity of the cows, the skill of the operator, etc. One of the most important conditions for increasing labor productivity in dairy farms and complexes for any method of keeping cows is the frequency of milking. Primary processing and storage of milk is one of the main aspects to improve product quality [1].

In farms and complexes, it is necessary to ensure compliance with high sanitary standards, technological requirements in preparing cows for milking and in the milking process. It helps

by keeping milking equipment and dairy department equipment in good condition, organizing systematic and adequate supply of filtering materials, disinfectants and detergents to farms and complexes. Organization of not only primary processing of milk in farms and complexes, but also industrial processing, including normalization, pasteurization, packaging in small containers (bottles or bags) through direct connections, including enables sales to stores and catering establishments [2]. As a result, the loss of product in terms of quantity and quality is minimized, and the costs of the dairy industry for the construction and maintenance of downstream collection points are reduced.

**Materials and methods**

In modern farms, the milking system can be semi- or fully automated. It is important to control the amount of milk being milked in the milking system. We will consider the general technological process of the milking system on farms.

Milking equipment has long been used on farms to obtain large quantities of milk. But this is not enough. Employees must know the physiology of cows, understand the peculiarities of using equipment, have an understanding of the productivity qualities of different breeds, feeding standards and sanitary requirements [3].

In order to get the maximum amount of products from cows, it is necessary not only to efficiently use the milking equipment, but also to observe certain technological rules from the beginning to the end of the process. It consists of basic operations in which the milker is not directly involved. And assistant - they are divided into preparatory and final. Both are performed by an employee using non-automated devices.

Even before milk pumps start pumping milk through the pipes, six preliminary operations must be performed:

- The employee goes to the next animal with the milking machine.
- The cow's udder is washed with warm (40 - 45 degrees C) water.
- The udder is wiped with a towel.
- The operator performs a stimulating massage of the udder.
- The first few streams of milk are released.
- Milking bottles are placed on teats.

After the milking department has completed its task and pleased the owner of the milk counter with new numbers, the final operations are carried out. There are six of them:

- The employee approaches the animal.
- Machine milking is organized.
- Suction cups are off.
- The glasses are removed from the nipples.
- The operator checks the condition of the udder after milking.

- The milk is drained (during milking into the milk box).

In milking parlors equipped with "Herringbone" or "Tandem" complexes, spray hoses are used to wash the udder. The udder is lightly massaged to create conditions for more active milk. As a result, the animal is ready to produce milk. This can be determined by how the nipples swell - they become more elastic. If the milking reflex does not work after washing and wiping the udder, then the milker should quickly massage the udder. To do this, he grabs the quarters with his fingers one by one and hits them from top to bottom, towards the nipples. In some animals, milk production begins only after such exposure [4].

After finishing the preparation of the animal, the milking bowls are placed. The operator loosens the clamp on the milk hose or opens the milk faucet, moves the apparatus under the udder with one hand, and places the glasses one after the other on the nipples with the other. To prevent suction, it is recommended to bend the tube when lifting the glass. Thus, air does not pass to the window - this is undesirable, because air leakage reduces the vacuum level in the line, so already connected devices begin to work poorly. Glasses order: near back, far back, far front, near front. If everything is done correctly, no squeaking sounds will be heard.

Milk is transported from the farm (or milk collection center) to the factory for processing. Different containers have been used to store milk at different times, and many of them are still used around the world today: from 2-3 liter glass and ceramic containers to modern refrigerated cargo tanks for storing thousands of liters of milk.

In the past, when dairies were small, milk was obtained from nearby farms. The microbial composition of the milk could be controlled with minimal refrigeration because the transport distances were short and the milk was collected daily. Today, there is a tendency to gradually increase the volume of dairy products. It is required to improve production and improve the quality of the final product. Milk can come from very far places, so daily collection is not possible. Currently, milk collection usually takes place every other day, but this interval can sometimes be up to three days [5].


Milk should be cooled to + 4°C immediately after milking and always kept at this temperature during transportation to the factory. If the cooling system breaks down on the way, for example during transportation, microorganisms start to multiply in the milk. This leads to the formation of various metabolic products and enzymes. Further cooling stops the development of bacteria, but the milk is

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already spoiled. The number of bacteria has increased and the milk now contains substances that affect the quality of the final product.

The first measures to preserve the freshness of milk should be carried out on the farm. Milking conditions should be as hygienic as possible; The milking system is designed to prevent contact with air, and cooling equipment is installed where necessary.

To meet hygiene requirements, dairy farms have special equipment for storing chilled milk. Transport tanks with a cooling system are becoming more and more common. These tanks, ranging from 300 to 30,000 liters (Figure 1), are connected to mixers and cooling equipment to meet certain requirements - for example, milk must be cooled to +4 °C within two hours of milking.

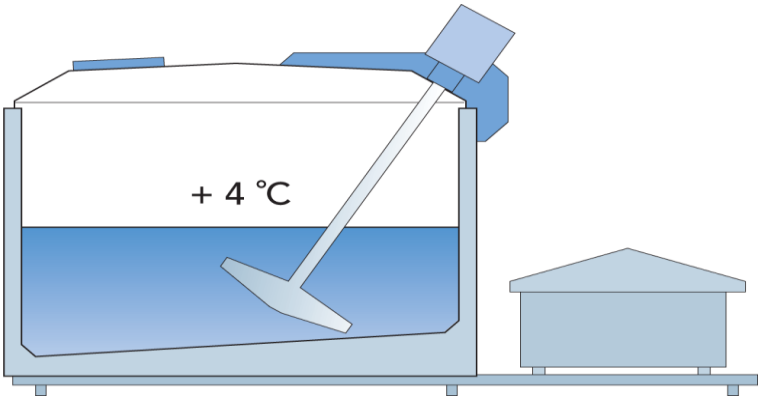


**Figure 1.** Transport tank with mixer and cooling device.

Large farms that produce large quantities of milk often install separate cooling platforms to cool the milk before it enters the tank (Figure 2). This prevents the warm, freshly obtained milk from mixing with what is already in the container.

The milking room should be equipped with washing and disinfection systems for milk containers, milking units and a cooling tank.

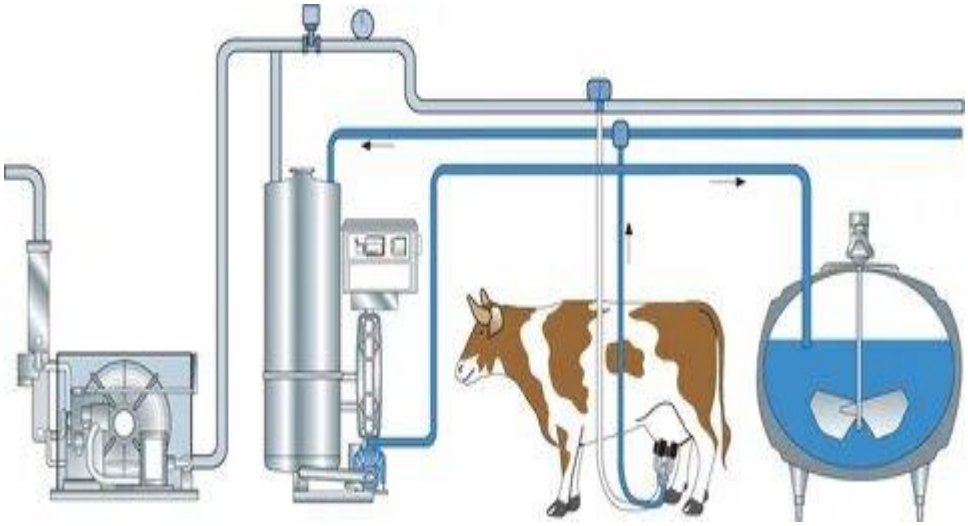

**Figure 2.** Flow diagram from milk cow to cooling tank to cooling system.

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**Results and Discussion**

It is important to store milk in large containers after milking, and it is also necessary to control the level of milk in milk storage containers. In addition, it is possible to constantly monitor the amount of milk produced using an automated monitoring system. In this case, it is important to control the level of milk in milk containers, besides, it will be possible to control the operation of the vacuum motor. The structural scheme of the technological process of monitoring the amount of milk milked according to our project is as follows (Fig. 3).

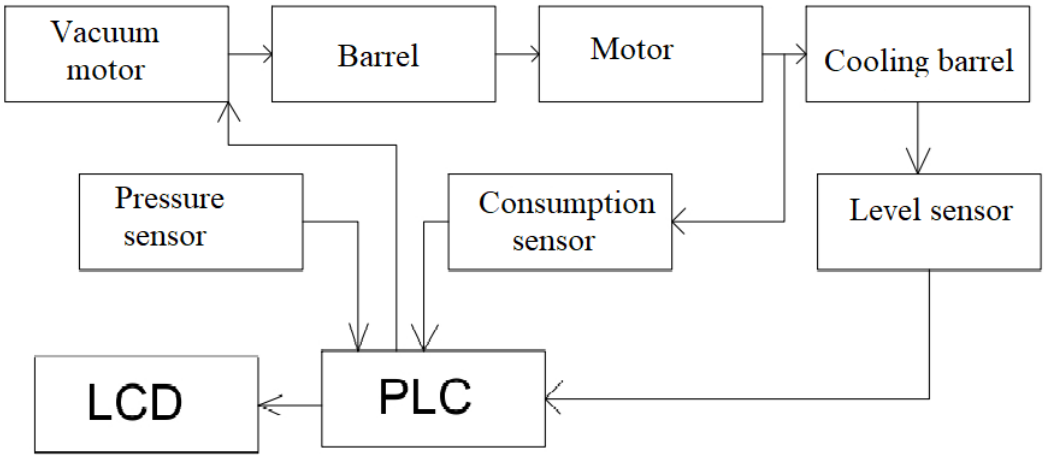


**Figure 3.** Structural scheme of the technological process of monitoring the milk quantity.

In this technological process, the vacuum motor pulls the milk into the barrel, and while the milk is drawn into the cooling barrel, the flow sensor measures the incoming milk, the MAG 5000 flow sensor is used, because this flow sensor meets the hygienic requirements for food liquids. A satx sensor is installed in the milk cooling barrel, which accurately shows the amount of milk in the barrel at that time, using the OPTWAVE 3500 satx sensor. This level sensor meets hygienic requirements and is the best option for measuring the level of milk products. These sensors transmit the data to the PLC and display it on the LCD1604. In the monitoring and automation of the total amount of healthy milk products in farms, the vacuum motor is controlled, the consumption of healthy milk is calculated, and the amount of milk collected in the cooling barrel is automatically monitored. The increase or decrease in pressure due to the vacuum motor has a great effect on the milking process, so the pressure is also controlled. Based on the data transmitted from the sensors, the PLC controls the automated system. System management is based on the following algorithm (Fig. 4).

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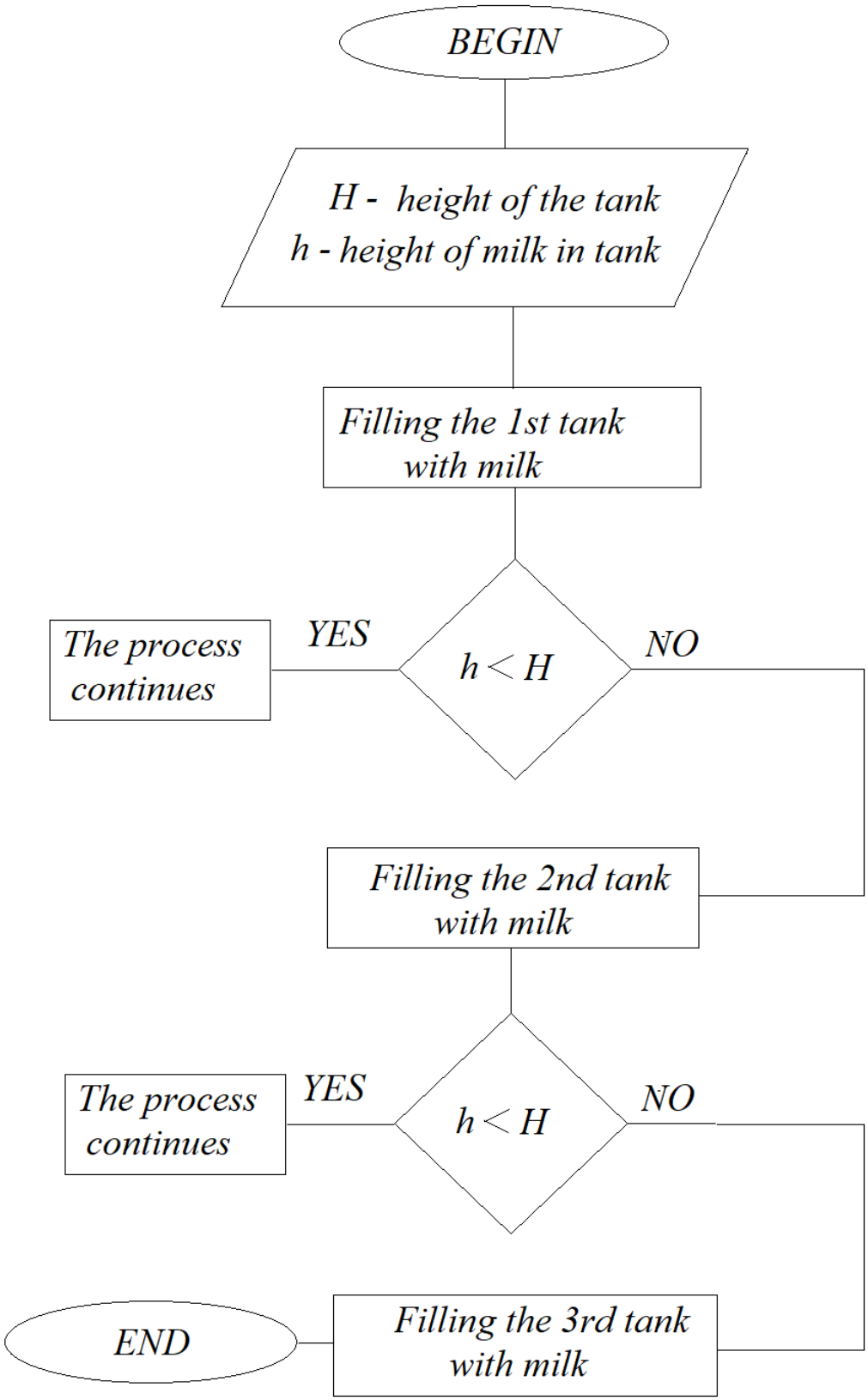


**Figure 4.** Algorithm for controlling the level of milk being milked in the cooling tank.

According to the algorithm, the milk being milked is first poured into the first tank, the level sensor in this tank measures the milk level h. The process of pouring milk into the tank

continues until the milk level h reaches the height H of the tank (h<H). If h<H is not fulfilled, that is, if the tank is filled with milk, milk will start pouring into the second tank, and after the second tank is filled with milk, milk will start pouring into the third tank. The capacity of each tank is known, so it will be possible to monitor how much milk is milked by controlling the level.

## Conclusion

The technological process of milking on farms was studied. The degree of automation of the process was analyzed. As a result of the analysis, a project structure was proposed to improve the technological process of milking. According to the project, a system control algorithm was developed, as a result of which it was stated that it is possible to automatically monitor the amount of milk being milked in farms.

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