

SECTION 11. AUTOMATION AND APPLIANCES MAKING

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SELECTION OF THE FUNCTIONAL SCHEME OF AUTOMATION OF THE TECHNOLOGICAL PROCESS OF TEMPERATING DURING THE PRODUCTION OF BLACK CHOCOLATE

The food industry of the country is one of the largest branches of the processing industry. And the state of the economy and the development of the markets of our state depend on its development. Dark chocolate occupies a proper place among the products of this industry. Due to its properties to lower blood pressure, reduce the risk of blood clots and improve the circulation of the heart [1].

The basis for the efficient and competitive development of enterprises is the automation of production. Therefore, to display the technical levels of automation of the dark chocolate production process, we will develop a functional diagram of automation of the tempering process [2].

The process of tempering chocolate masses begins after the chocolate mass is fed at a temperature of 45-50°C into a cone-shaped mixer with a water jacket from the hopper, where it got after the preliminary processes for making the chocolate mass [3].

After filling the tamper chamber with chocolate mass to a predetermined limit, the level sensor 1-1 is triggered and the data is transmitted evenly to the measureless 1-2, fig. 1. Switch 1-4 gives a signal that the corresponding filling level of the tamper chamber has reached valve 1-5 and the supply of chocolate masses is stopped. This continues until the mass level in the tamper chamber again falls below the predetermined level. Then the indicator of the level of the substance in the tank 1-3 sends a signal to the switch to open the valve.

If the tamper chamber is filled to the required limit, then the substance level indicator 1-3 gives a signal to the electric motors 1-7 and 1-9, which actuate the stirrer and the five-way screw, respectively. Thanks to stirring, uniform cooling and supply of the substance to the horizontal cylinder, divided into three sections, is carried out. Cooling also takes place in a tempering chamber, the walls of which have a lower temperature than the chocolate mass. A temperature meter 5-1 is installed on the wall of the water jacket, connected to a thermometer 5-2, which transmits the readout data of the device for the measurement indicators installed on the shield 5-3. To maintain a constant temperature in the water jacket, the water is constantly changing due to its supply from the tank through pipes.

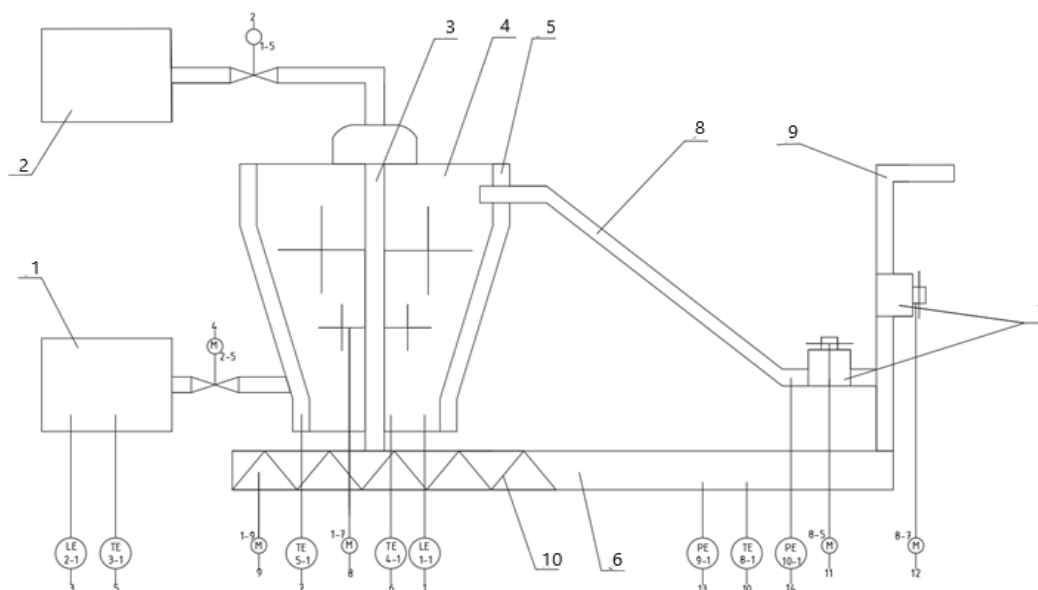


Fig. 1. Functional diagram of the tamper chamber: 1 – container with water; 2 - container with chocolate; 3 - stirrer; 4 - cone-shaped container; 5 - water jacket; 6 – horizontal cylinder; 7 - crane-pump; 8 - inclined pipe; 9 - outlet pipe; 10 - five-way auger

The scheme works as follows. In the water tank there are sensors 2-1 and 3-1 - respectively a level meter and a temperature meter. The level sensor 2-1 notifies the level measuring device with remote readings 2-2, which, in turn, transmits information to the panel to the device indicating the level of the substance in the tank 2-3. If the water level in the tank is restored and corresponds to the set value, then the signal is sent to sensor 2-4, the valve with the pump opens and the cooling water enters the water jacket. Since the water from the water jacket has a markedly elevated temperature, the process of controlling the temperature of the water is very important. Thanks to the metal cooling tubes in the tank, the water is cooled. In order to know the temperature of the water in the tank, a temperature measurement sensor 3-1 is installed, connected to a scaleless temperature measuring device with remote transmission of readings 3-2. The latter remotely transmits signals to the device for determining the temperature and is installed on the shield 3-3. To control the temperature of the chocolate masses, a temperature meter 4-1 is installed inside the cone-shaped container. The temperature gauge 4-2 displays information for the temperature gauge 4-3 located on the switchboard.

After the first and second tempering zones, sensors are installed that transmit a signal about the temperature of the devices. Thermometers have two arrows: adjusting and showing. The third device shows the temperature of the water in the jacket of the third zone and the jacket of the outlet pipe. The setting arrows of the thermometers are interlocked with relays and electromagnetic valves that automatically regulate the water supply to the jacket of the corresponding zone.

The temperature of the chocolate mass when leaving the first cooling zone should be 33-34°C, and from the second zone - 31-32 °C. To maintain this temperature, water at a temperature of 31-32°C is supplied to the jackets of the third zone and outlet pipes. Thus, the chocolate mass entering the molding always has a constant temperature and viscosity. After passing through the cylinder, the five-way screw and sequentially passing through the zones of the tempering chamber, into the shirts of which water is continuously supplied, the chocolate mass acquires the desired temperature. Moving along the conveyor, chocolate enters the second zone, in which there is a temperature measurement sensor 8-1, which transmits a signal about the temperature of the device installed in place 8-2. He remotely transmits the received signal to shield 8-3. If the chocolate temperature corresponds to the set value and satisfies the conditions, then the

signal is sent to the sensor 8-6, which opens the valve-pump 8-7 and the chocolate mass goes to the next stage of chocolate production and the tempering process is completed. Although the tempering process is carried out continuously, however, if the chocolate mass does not meet the set temperature, then the signal from 8-3 is sent to the sensor 8-4. Which, in turn, activates the valve-pump 8-5, closes the valve and opens the valve on the inclined pipe, with which the mass returns to the machine.

To control the pressure in the horizontal cylinder and the inclined pipe, pressure sensors 9-1 and 10-1 are installed, respectively, transmitting the information received to the automation panel.

References:

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