

DESIGN OF A SEMI-AUTOMATIC BREAD-MAKING MACHINE INCLUDING MEDIUM CAPACITY WITH A VARIETY OF BAKING TEMPERATURES

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Abstrak.

Mesin roti juga merupakan daya ungkit untuk meningkatkan kapasitas produksi dan juga kualitas produksi. Berbeda dengan produksi roti secara manual yang memerlukan banyak tenaga dan waktu, mesin roti menjadikan segalanya lebih efisien. Output mesin roti ini lebih bagus dibandingkan dengan output produksi manual. Disamping itu, Roti yang dihasilkan lebih terjamin higienitasnya. Mesin ini sangat steril dan aman karena semua bahan material terlindungi dengan plat stainless dan dengan nyala motor mixer yang bisa disetel sesuai dengan kebutuhan dan oven yang otomatis sesuai keperluan. Pada nampan menggunakan bahan yang higienis dan tidak membahayakan kesehatan serta ramah lingkungan bebas polusi. Tingkat keamanan penggunaan lebih tinggi karena memiliki dimensi yang sesuai. Teknik pengoperasian mesin pembuat roti semi otomatis dengan kapasitas produksi 4 kg membutuhkan waktu 45 menit dengan temperatur proses pengovenan pada 100 °C sampai dengan 150 °C.

Kata kunci: mesin pembuat roti, semi otomatis, temperatur, kapasitas.

Abstract.

The bread machine is also a leverage to increase production capacity and production quality. In contrast to manual bread production, which requires a lot of effort and time, a bread machine makes everything more efficient. The bread machine's output is better than manual production's. Besides that, the hygiene of the bread produced is guaranteed. The device is sterile and safe because all materials are protected with stainless plates, a mixer motor flame that can be adjusted according to needs, and an automatic oven according to requirements. The tray uses hygienic, not harmful to health, and environmentally friendly and pollution-free materials. The level of safety in use is higher because it has appropriate dimensions. The technique for operating a semi-automatic bread-making machine with a production capacity of 4 kg requires 45 minutes with an oven process temperature of 100 °C to 150 °C.

Keywords: bread making machine, semi-automatic, temperature, capacity.

Introduction.

One of the obstacles to increasing production is caused by the manufacturing process because it still relies on manual labour. This bread dough kneading tool has been able to help the process of making bread faster. A bread dough kneading tool, which usually takes a long time if done manually, can be reduced or reduced significantly. Besides that, much human energy is expended

on manual bread dough kneading machines, which can be minimized by using a bread dough kneading tool [1]. Shorter times result in not being able to optimize production capacity. For this reason, ovens that utilize heat energy from electrical materials will be designed. Apart from that, product hygiene is also a factor that partners ignore. The conventional oven process has several weaknesses: low product hygiene and time consumption. It affects the production process, which reduces product quality [2].

The automatic electric furnace is a furnace that uses electrical energy as the main fuel for burning the stove. Electricity is the main power that drives the heater and the furnace controller. Electric stoves are easier to control than gas stoves. Electric furnaces in temperature control generally use thermocouple sensors and thermostats as heating element switching regulators. While maintaining the time on the stove, typically use a timer. A thermocouple is an active transducer for temperature, composed of two different metals with a reading point at the junction of the two metals and another point as the output [3]. A heating element is a device that converts electrical energy into heat energy through the Joule Heating process. Requirements for the heating element, among others, must be durable at the desired temperature, its mechanical properties must be strong at the desired temperature, the coefficient of expansion must be small so that the change in shape at the desired temperature is not too large, the specific resistance must be high, and the temperature coefficient must be small so that the working current is as much as possible constant. The timer on the electric oven serves to set the working time which will cut off the electricity to the heating circuit if a predetermined time value is exceeded [4].

Mixing equipment using one stirrer is usually used to stir materials with low viscosity while mixing equipment with more than one propeller is used to initiate materials with high thickness. Factors that influence mixing include particle size, shape and density of each component, the efficiency of the mixing equipment for each element, surface water content of the food, and flow characteristics of each food [5]. The stirring or mixing process has the main purpose of forming the gluten network found in wheat. The gluten network will develop over time when you add water to the flour and undergo a kneading process. The kneading process will stop when the gluten network has formed completely or is known as smooth. One of the influential factors in the mixing process is the rotation of the mixer machine, so it is necessary to study how much influence the course has on the physical properties of the bread [6].

One of the obstacles to increasing production is the manufacturing process because it still relies on manual labor. This bread dough kneading tool can help make the bread-making process faster. A bread dough kneading tool, which usually takes a long time if done manually, can be reduced or reduced significantly. Apart from that, the human effort expended on a manual bread dough kneading machine is quite large, which can be minimized using a bread dough kneading tool. For this reason, a furnace will be designed that utilizes heat energy from electricity. Apart from that, product hygiene is also a factor that partners do not pay attention to. The conventional oven process has several weaknesses: low product hygiene and time consumption. It affects the production process, which reduces product quality. Because of this, tools are used to make dough and bake bread raw materials that do not depend on manual labor. As mechanical engineering graduates, we need to know the process, how it works, and the advantages and disadvantages of these tools.

Research Methods

In planning, we must first arrange or create a picture flow regarding the machine we will make. Before working on the device, we must prepare the tools and materials needed to make the machine. The tools required must be appropriate to their function so that our work will not be hampered, and the materials must also suit the needs of the machine we will make. Before we enter the assembly process, it's a good idea first to check the material that has been cut. So that the assembly process can run smoothly, after all the materials have been measured one by one, we start cutting the materials according to the dimensions we have measured earlier. Use cutting tools according to the material and function. After the tools and materials have been collected, we first calculate the raw materials so there are no errors during the process, and we don't make mistakes during the

measurement process because it will hinder our machining process [7][8]. If all the raw materials are ready, we will prepare the supporting equipment for assembling the raw materials individually, from forming to welding, driving components, and other components according to the drawings and machine workflow. After all the raw materials are assembled according to our design drawings, we must first test whether there is a problem with our tool or not. If the machine has been tested and is in accordance with our wishes, then we have to dismantle the components that we have assembled again to paint our frame/engine. After the painting process is complete, we reassemble our machine, which we dismantled earlier, and our machine can be operated and ready to be marketed.

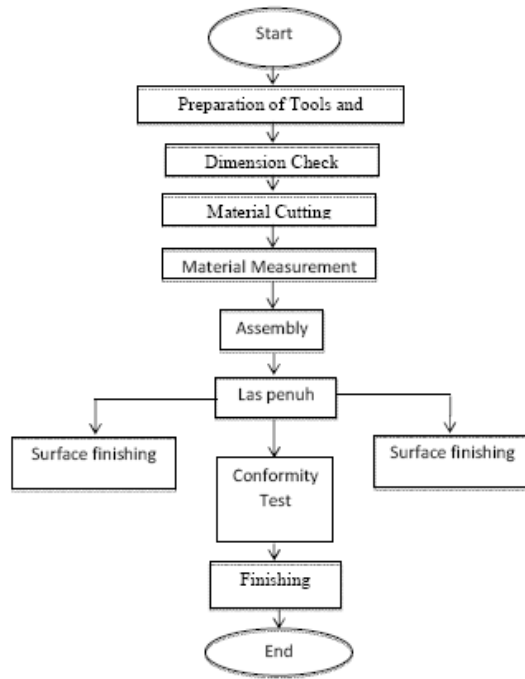


Figure 1. Flow Diagram for Designing Mixer Machines and Bread Furnace.



Figure 2. Machine Component Parts

The performance test of the drying furnace machine is an effort to determine how the machine that has been made works and its efficiency [9]–[13][14]. This test is also intended as a step to monitor deficiencies in the device that cannot be overcome. Testing is also carried out on each component in the machine to determine whether all features can function as expected. So that improvements and innovations can be made to the engine for the subsequent manufacture. The initial preparation that is carried out is to prepare the dough ingredients for making bread, such as eggs, flour, water, and other components. For making bread, and if we want the bread to look colorful, we can also add coloring so that the bread looks different from the others. This drying furnace machine works by drying the product at the desired temperature (the temperature can be set constantly).

Results and Discussion.

There is a planning process in the design step of this semi-automatic bread-making machine. The planning process should be carried out sequentially according to the diagram to increase production efficiency. Several aspects are considered in making machines: the availability of goods, price of materials, costs of joining/welding, processing time, machining costs, and working costs [15], [16]. Design is an essential first step in making or modifying a machine. The stage was conducted to obtain accurate data for making good machine construction and bread-making machines. Technical analysis and design were carried out in making the machine. The plans for knowing the target and testing the wind speed on the drying furnace machine are as follows: Firstly, the expected target weight for the furnace machine's capacity is to be able to contain 4 kg of dough in each production. The mixer machine also has a total of 4 kilograms per dough. Second, test the motor speed on the mixer. It is necessary to try the mixer to find out the amount of power that occurs when the motor speed test occurs. Testing the motor speed power and stirrer shaft speed is carried out. The frame is an important part that supports the machine's standing firmly when operated. The selection of materials and the correct connection process will influence the frame's strength as a support for the device so that the structure can withstand the maximum load being carried out. Dimensional tests are carried out to determine whether the size of the material changes or not after undergoing processing. After the dimensional test, the results obtained follow the image below.

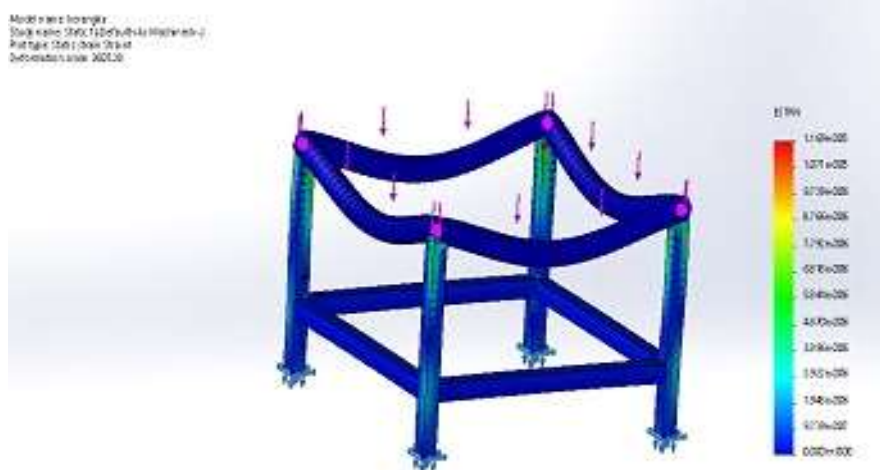


Figure 3. Buffer Strength Calculation Semi-Automatic Bread Making Machine

The overall test of the bread-making machine was carried out by measuring the length of processing time. The time size is determined by how many degrees of heat the temperature is used and by the water content contained in the Material to be processed. To measure the amount of water content in this Material, the authors use the gravimetric method to measure the water content in the Material to be processed. These two materials have different water contents. The first test used bread dough as a sample, which had an initial wet weight of 80 grams with a damp basis moisture content of around 23%; the calculation of the wet basis moisture content and the dry basis moisture content was

obtained by using equations 1 and 2, namely the weight of water (Ba) at Material is expressed as the weight of the Material before drying minus the importance of the Material after drying. So, the initial or pre-dried Material weighs 80 grams minus the base material after drying, which is 65 grams. The result is 15 grams (Ba), and the absolute dry matter weight (final weight) is obtained from the Material weight after drying, which is 65 gr.

Table 1. Heating Capacity Of The Furnace

No.	Sampling	Water content (%)		Temperature (°C)	Time (min)
		Wet	Dry		
1.	1kg	23%	18,75%	80 – 110	40
2.	1 kg	23%	18,75%	110 – 150	30
3.	1 kg	23%	18,75%	150 – 200	20

After knowing the wet and dry bases of the material, we can understand how long the oven process will take, with the water content on the damp basis being 23% and on the dry basis being 18.75%. Table 1 shows how long the baking process takes at a working temperature of 100 °C and an operating temperature of 150 °C.

Conclusion.

The technique for operating a semi-automatic bread-making machine with a production capacity of 4 kg takes 45 minutes. For the mixer 4 kg 45 minutes, the use is relatively straightforward: pressing the on button to turn on the machine, placing the dough ingredients in the bowl mixer, and adjusting the speed as needed. Put the dough in the oven on the tray, then adjust the temperature according to the standard. The machine is sterile and safe because a stainless plate protects all materials, a mixer motor flame that can be changed, and an automatic oven as required. The tray uses materials that are hygienic and not harmful to health. Environmentally friendly, pollution free. The level of usage comfort is higher because it has the appropriate dimensions. The frame and engine use stainless steel, making engine maintenance easier.

Daftar Pustaka.

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