Design And Fabrication Of Semi Automatic Noodles Making Machine

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Abstract- *Noodles, a staple food across many cultures, are typically made from starch-based dough that's stretched, extruded, or rolled flat and cut into various shapes. While traditionally made from grain flours, modern noodles can also be crafted from alternative sources like cassava, yams, or potatoes.*

While industrial noodle-making machines exist, they are complex, expensive, and bulky, usually requiring multiple operators. These machines are not suitable for smaller-scale use due to their cost and reliance on specialized components. However, they are efficient for large-scale noodle production, transforming dough into uniform noodles through a series of operations such as rolling, cutting, and shaping.

This project aims to help people in making noodles easily, quickly and on a wider scale. The first stage of the project with brainstorming, visualizing the idea, forecasting all our needs in the project and deeper research was held between all competitive noodle machines in the market. Design and development of noodle machine by integrating all ideas together and testing of Semi Automatic noodle machine which is operated by AC-power source.

I. INTRODUCTION

1.1 History

The history of semi-automatic noodle-making machines is characterized by significant advancements in noodle production efficiency and consistency. Initially, noodle-making was a manual process, requiring extensive labor and time. The introduction of semi-automatic machines revolutionized the industry by automating several key steps while still requiring some human intervention. These machines emerged in response to the growing demand for noodles and the need to streamline production processes. They allowed for faster dough mixing, kneading, and shaping compared to traditional methods.

Early semi-automatic noodle machines were relatively simple, often requiring manual feeding of ingredients and monitoring of the production process. However, they significantly reduced the physical exertion and time required compared to manual methods.

Over time, technological advancements led to the development of more sophisticated semi-automatic machines with enhanced capabilities. These machines incorporated features such as automatic ingredient feeding, precise dough consistency control, and adjustable cutting mechanisms.
Here is an overview of their evolution-

1. East Asia
2. Central Asia
3. Ancient Israel
4. Polish Jews

1.2 Applications

A noodle making machine is a versatile piece of equipment used in the food industry and households to automate and streamline the process of noodle production. These machines come in various sizes and configurations, but their primary function is to mix, knead, roll, and cut dough to produce noodles of different shapes and sizes. Here are some applications of noodle making machines:

1. Commercial Noodle Production
2. Small-scale Noodle Production
3. Household Use

1.3 Types of Noodle Making Machine-

1. Manual Noodle Maker
2. Electric Noodle Maker
3. Commercial Noodle Making Machine
4. Automatic Noodle Making Machine
5. Semi- Automatic Noodle Making Machine
6. Instant Noodle Machine

II. METHODOLOGY

2.1 General Theory of Machine

A noodles making machine is a device used to automate the process of making noodles. These machines typically mix flour and water to form dough, then extrude or cut the dough into noodle shapes.

There are various types of noodle making machines available, ranging from small, manual machines suitable for home use to large, industrial machines used in commercial noodle production. Some machines are designed specifically for making certain types of noodles, such as spaghetti, ramen, or udon, while others are more versatile and can produce a variety of noodle shapes and sizes.

While specific designs may vary, here is a general theory about how such a machine works:

1. Ingredient Mixing
2. Kneading
3. Sheeting
4. Cutting

2.1.1 Input Parameters

There are various input parameters that can be changed to different values to obtain perfect results such input parameters are as follows:

The input parameters for a semi automatic noodles making machine can vary depending on the specific machine design and requirements. However, here are some common input parameters that may be involved:

1. Ingredients
2. Dough consistency
3. Sheet Thickness
4. Raw material
5. Power Supply

2.1.2 Laws and Mechanism

The laws and mechanisms used in semi automatic noodles making machines can vary based on the specific design and functionality of the machine.

In a noodle making machine, the gear and roller mechanism plays a crucial role in sheeting and cutting the dough to produce noodles. Here's an overview of how this mechanism typically works:

Gear Mechanism:

- The gear mechanism in a noodle making machine is responsible for driving the movement of the rollers that flatten and cut the dough.
- It typically consists of gears and shafts connected to a motor, which provides the necessary rotational force to power the rollers.
- The gear ratio determines the speed and torque applied to the rollers, influencing the thickness of the dough sheet and the cutting speed of the noodles.

Roller Mechanism:

- The roller mechanism consists of two or more cylindrical rollers arranged in parallel or in a series.
- These rollers are usually made of food-grade materials such as stainless steel and are precisely machined to ensure uniformity in dough sheet thickness.
- The rollers can be adjusted vertically or horizontally to control the thickness of the dough sheet.
- Some noodle making machines may also feature textured or patterned rollers to imprint designs or textures on the dough sheet for specific types of noodles.

2.1.3 Output Parameters:

The output parameters in a semi automatic noodles making machine refer to the characteristics and specifications of the produced noodles. Here are some common output parameters:

1. Production Capacity
2. Noodle type and shape
3. Thickness control

2.1.4 Components:

In the design and fabrication of the semi automatic noodle making machine, the following components have been utilized:

1. **Motor:** The motor is responsible for providing the power and rotational motion required for the machine's operation.
2. **Motor shaft:** The motor shaft connects the motor to other components of the machine, transmitting rotational energy.
3. **Shaft:** The shaft serves as a central axis for various rotating parts and transfers motion and torque between different components.

4. **Pulley:** Pulleys are used for power transmission and speed regulation. The machine incorporates multiple pulleys, including those attached to the motor, shaft, and crankshaft, to ensure proper power distribution.
5. **Belts:** Belts connect the pulleys, transmitting power from one component to another. They facilitate the movement and synchronization of different parts of the machine.
6. **Gears:** Helical gears used in semi automatic noodle making machine because they provide smooth, quiet and efficient transmission of motion and power between two parallel shafts.There are three gears used in machine – first is mounted on the main shaft, Second is mounted with rollers and third is mounted with noodle cutter. All gears connected with each other.
7. **Rollers:** The rollers are used to making sheet of dough while passing dough through it. Rollers are the main components installed on the main machines of noodle and instant noodle. The flour flocks matured by the Dough mixing machine are continuously rolled by the compound machine and continuous presser.
8. **Roller Adjuster:** Roller adjuster is used to adjust or control the thickness of sheet.
9. **Sliding Plate:** It is used passing sheet to the cutter. It is situated between the roller and cutter.
10. **Noodle Cutter:** A noodle cutter is an essential component in a commercial noodle making machine. Its primary function is to cut or shape the flattened dough produced by the noodle roller into the desired noodle shapes.
11. **Cutter Adjuster:** It adjusts the thickness of noodle.
12. **Noodle Collector:** A noodle collector is a component of a noodle making machine that gathers and organizes the noodles as they are extruded or cut from the dough. Depending on the design of the machine, the noodle collector may take different forms.
13. **Supporting Plates:** Supporting plates typically refer to flat, rigid surfaces or structures used to provide stability, reinforcement, or support to various components or systems. Supporting plates can be made from a variety of materials, including metals (such as steel or aluminum), depending on the specific application requirements, including factors such as load-bearing capacity, durability, corrosion resistance, and thermal properties.
14. **Frame:** The frame provides the structural support and stability for the entire machine, housing and connecting all the components.
15. **Bolts:** Bolts are used for assembling and securing various parts of the machine. In this project, bolts are utilized to attach the big and small bearings, motor, and other components to the frame.

These components collectively contribute to the functionality and efficiency of the semi automatic noodles making machine, enabling the production of eco-friendly food service products.

III. MODELING AND ANALYSIS

3.1 Specification of Components

Table 1.0 Components Specifications

Name of Components	**SPECIFICATIONS**
Motor	Power: - 1 HP, Rpm: - 1440
Motor shaft	Diameter: 30.53 mm, Length: 440 mm
Pulley	**Motor Shaft Pulley** Inner Diameter: 10.00 mm Outer Diameter: 54.50 mm Length: 60 mm **Double Groove Pulley** Inner Diameter: 25.40 mm Outer Diameter: 406.40 mm Length: 12.70 mm
Belts	**BELT 1** Dimension: Length: 1866.30 mm **BELT 2** Dimension: Length: 1682.24 mm
Gears	**Main Gear 1** Inner Diameter: 10.00 mm Outer Diameter: 54.50 mm No. of teeth: **Gear 2** Inner Diameter: 10.00 mm Outer Diameter: 54.50 mm No. of teeth:
Rollers	**Roller 1** Inner Diameter: 10.00 mm Outer Diameter: 54.50 mm **Roller 2** Inner Diameter: 10.00 mm Outer Diameter: 54.50 mm **Length :** 381mm
Roller Adjuster	Quantity : 2

	Length: 110 mm
Sliding Plate	Length: 381mm Height: 220 mm
Noodle Cutter	Weight: Length: 381mm
Cutter Adjuster	Quantity: 2
Supporting Plates	NO of plates: 2 Width : 50.8mm
Frame	Dimensions: Outer Frame: Length x Breadth x Height: 889mm x 381mm x 558.08 mm Parts: Channel: Quantity: 10 6 Parts of (40 mm x 70 mm x 40 mm, 2 mm): Length: 756 mm (4 parts) 2 Parts of (Length: 681 mm) Angle: Quantity: 10 2 Parts of (Length: 1,016 mm) 7 Parts of (30 mm x 30 mm x 30 mm, 2 mm): Length: 756 mm
Bolts	**Nuts:** Type: Hexagonal Diameter: 6.8 mm Length: 40 mm **Washer:** Type: Circular Inner Diameter: 13.57 mm Outer Diameter: 25.40 mm Length: 2.8 mm **Bolt:** Type: Threaded Inner Diameter: 8.00 mm Outer Diameter: 13.00 mm Length: 45 mm

3.2 Machine Modeling

Machine modeling refers to the process of creating a representation or simulation of a machine system using mathematical and computational techniques. It involves capturing the physical characteristics, behavior, and interactions of the machine components to analyse and predict its performance.

1. System Identification
2. Mathematical Modeling
3. Parameters Estimation
4. Model Validation
5. Computer-Aided Design (CAD)
6. Simulation
7. Analysis and Optimization

3.3.1 Selection Design Criteria

Here are some commonly considered selection design criteria:

1. Performance
2. Functionality
3. Reliability
4. Safety
5. Cost-effectiveness
6. Size and Weight
7. Environmental Impact
8. Compatibility and Integration
9. Regulatory and Standards Compliance
10. Customer Requirements

3.3.2 Design Procedure

The detailed design procedure for a machine typically involves several steps to ensure that the final product meets the desired specifications and requirements. Here's a general outline of the process:

1. Identify the Design Problem
2. Conceptualization
3. Preliminary Design
4. Analysis and Evaluation
5. Detailed Design
6. Prototype Development
7. Testing and Verification
8. Iterative Design
9. Finalize Design
10. Production and Implementation
11. Post-Design Evaluation

3.3.3 Drawing of Major Components

There are various components and in those some major components are:
Pulley

Machine Views

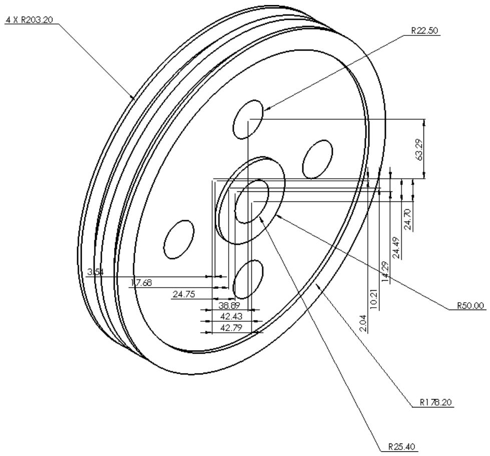

Fig 1.0 Auto CAD drawing of Pulley

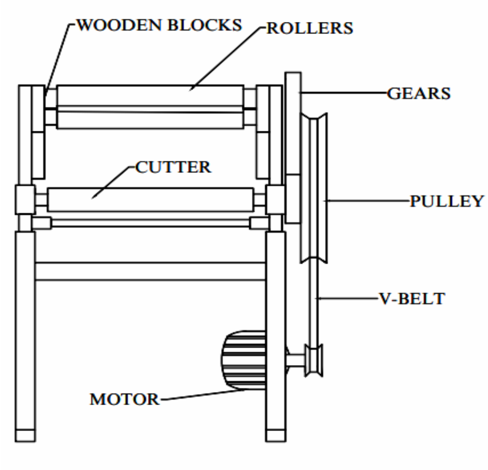

Fig 2.0 Front view

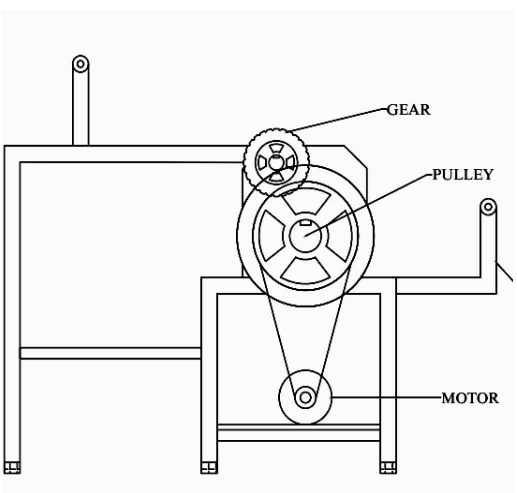

Fig 3.0 Side View

3.3 Mathematical Modeling

Motor Rpm: 1440 rpm

There are some notations that are as given:

Diameter of Motor Pulley = D_1
Diameter of Double Groove shaft Pulley= D_2
Rpm of Motor Pulley = N_1
Rpm of Double Groove shaft Pulley= N_2
Revolution of main pulley N_2=?
Rpm (Motor) =N_1= 1440
Diameter of motor Pulley (d_1) = 0.0762 m
Diameter of main Pulley (d_2) = 0.4572 m
From equation,
$N_1/N_2=D_2/D_1$
$1440/N_2= 0.4572 / 0.0762$
$N_2=1440 * 0.0762 / 0.4572$
$N_2=240$ rpm

Revolution of main pulley N2=240 rpm

The gear connected with shaft= 240 rpm
Diameter of gear connected with shaft =0.0635 m
Gear connected with rollers,
Diameter = 0.3556 m
Revolution per minute = gear connected with shaft * Diameter of gear connected with shaft/ Dia. of Gear connected with rollers

$= 240*0.0635/0.3556 = 42.85$ rpm

Revolution of Rollers = 42.85 rpm ~ 43 rpm

The gear connected with shaft = 240 rpm
Diameter of gear connected with shaft = 0.0635 m
Noodle cutter,
Diameter Of cutter gear = 0.0889 m
Revolution of cutter,
Revolution of main gear/Revolution of cutter = Dia .of cutter gear/Dia. Of main gear

Revolution of cutter = 240*25/35 = 171.42 rpm

Angular velocity of rollers (ω_1) = $2 \pi N/60$
$= 2 \pi * 43/60$
$= 4.50 \sim 5$ radian/sec.
Angular velocity of cutter (ω_2) = $2 \pi N/60$
$= 2 \pi * 171.42/60 = 17.94 \sim 18$ radian/sec.
Linear velocity of rollers (v_1) = $\omega_1 * r_1$
$= 5*0.0762 = 0.381$ m/s
Linear velocity of rollers (v_2) = $\omega_2 * r_2$
$= 18*0.0254= 0.4572$ m/s
Where,
r_1 = Radius of Roller
r_2 = Radius of cutter

IV. RESULTS AND DISCUSSION

4.1 Raw Material Research and Analysis

To ensure the production of high-quality products, we conducted thorough research and analysis on the raw materials used. Here are the key areas we focused on:

1. **Material Properties:** We studied the properties of the raw material, such as its strength, durability, corrosion resistance, and other relevant characteristics. This helped us select materials that meet the required specifications and ensure product longevity.
2. **Availability and Cost:** We assessed the availability and cost of the raw materials, considering factors such as sourcing, transportation, and market fluctuations. It was important to select materials that are readily available and cost-effective without compromising quality.
3. **Environmental Impact:** We considered the environmental impact of the raw materials used. This involved evaluating factors such as their sustainability, recyclability, and eco-friendliness. We aimed to minimize the ecological footprint of our production process.
4. **Quality Assurance**: We implemented stringent quality control measures to ensure that the raw materials meet the desired standards. This included conducting material testing, inspections, and certifications to guarantee consistent quality and performance.
5. **Supplier Assessment:** We conducted a thorough evaluation of potential suppliers to ensure their reliability, reputation, and ability to provide consistent and high-quality raw materials. Building strong relationships with trusted suppliers is crucial for a reliable supply chain.

By conducting comprehensive research and analysis in both machine and raw material aspects, we have aimed to optimize our production process, enhance product quality, and ensure customer satisfaction.

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