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Fabrication and Assembly of Rotti Making Machine

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ABSTRACT

Flatbreads are very popular especially in those parts of the world where bread constitutes a major source of dietary protein and calories. There are several forms of flatbread, and the variation is mainly in terms of ingredients, technology, and quality. Several modifications in the formulations have been made in the recent past to improve the quality and delicacy of these food products. With urbanization and industrialization, the demand for ready-to-eat and easy-to-carry products resembling flatbread in appearance, but having desirable qualities of bread offers one exciting possibility to this effect. At present domestic and mass production purpose chapatti making machines are already available. With those machines, we can't prepare jowar, daal, rice, bajra, rottis. For that, a plan is executed to fabricate a machine that can make all the varieties of rotti's and chapatti. The design of rotti making machine was more innovative and challenging because of the least reference material availabilities and later the fabrication of all the parts have been carried out. In the current work, all the parts are fabricated as per the design and then assembled to verify the functionality of the machine.

Keywords: Rotti making machine, Fabrication, bread, jowar

I. INTRODUCTION

Rotti making machine will give an added advantage in the market. At present domestic and mass production purpose chapati making machines are already available. With those machines, we can't prepare jowar, daal, rice, bajra, rottis. For that, a plan is executed to do a machine which can make all the varieties of rotti's and chapatti. And know the point arises is why this machine. Why means, that peoples who are from north Karnataka, regularly use to have rottis as their main meal. These rottis are known to man since for many years, it rapidly gained importance for their nutritional and health benefits, However, recent research has revealed that this grain has unique health benefits for humans when compared to rice and wheat, jowar which is also called sorghum has a great amount of calcium, it also comprises with iron, magnesium, and fiber it also lowers cholesterol levels and other health benefits are as follows: [1]–[3]

1. It is gluten-free: gluten is a protein component found in wheat and barley-based foods and is believed to cause digestive problems such as bloating, pain, and stomach cramps, jowar, a gluten-free whole grain, is considered an excellent alternative for people who suffer from 'gluten intolerance' and it is rich in nutrients as well.
2. Well-heeled in fiber: compared to other cereal grains like barley or rice, jowar contains a much higher concentration of fiber, a single serving contains more than 12 grams which is more than the recommended daily, it reduces the fatness, improper indigestion, also keeps in control on blood pressure and reduces the heart-related issues.
3. High protein: one cup of jowar has 22 grams of protein, which supplies the body with energy as well as aids in cell regeneration
4. Full of iron: jowar contains 8.45 milligrams of iron in every cup, since the iron in jowar is difficult to enforce pairing it with meat or a source of vitamin C will give maximum benefit.
5. Controls blood sugar levels: jowar a complex carbohydrate is ingested slowly, enraging a gradual rise in blood sugar. That's why it's a great diet choice for diabetics and people who want to lose weight.
6. Good for bone health: because it contains a high level of magnesium, jowar helps to maintain calcium levels in the body.
7. Packed with vitamins, minerals, and micro-nutrients. it contains` B 'vitamins, which help the body to build new tissues and additionally jowar contains traces of zinc, copper, and over 20 micronutrients as well as a high level of antioxidants.

Preparing rotties manually is a very hard job. Continuous production of rotties is difficult. Skilled persons are needed to make rotties manually. Manual rotti preparation is acceptable for small families where the quantity needed is small. For commercial purposes, the manual procedure is not economical. The rate of production of rotti in the commercial field needed is more. The quantity required is also more. For the above-said problem, the only solution to fulfill the commercial requirements of Rotties can be solved by an automated or semi-automated production process. Hence this research on roti-making machines by the semi-automatic process has seen taken into consideration.[4]–[7]

Table 1 The content of 1cup of jowar is shown in the table

CONTENTS	JOWAR 1CUP
Calories	651 kcal
Carbs	143g
Protein	21.7g
Fiber	12g
Fat	6.3g
Magnesium	316.8g
Phosphorous	551g
Potassium	672g
Calcium	53.8g
Iron	8.4g

II. Survey on Existing Machines

Various Surveys Done On Existing Rotti Making Machine:

A. Semi-Automatic Portable Un baked Rotti Making Machine:

Fig.1 Semi-automatic portable unbaked rotti making machine

The machine shown in Fig.1 is a semi-automatic uncooked rotti making machine. This was found in the working women, placed at Raichur. The whole body of this machine is made up of mild steel, consists of four legs to withstand the overall load/weight of a machine. Two rollers are hollow tubes attached by the bearing with gears to the handle. Two rollers are supported at both sides with the help of two adjustable frames fixed at both ends as shown in Fig.1. The thickness of the rotti sheet is increased or decreased based on the need by adjusting the nuts provided over the end frames. Here atta is mixed separately, kept in the place provided behind the rollers, and pushed or pressed by the hand so that the flour will get pass between the two rollers and comes out in the form of a thin sheet afterward for cutting, a plate is pressed over the sheet the pattern is formed on the sheet same as that of the plate used for pressing. Finally, the uncooked rotti is removed and heated on Tava at the required temperature. This is how this machine works. As this requires a lot of time and numbers of peoples are involved in mixing, pressing, cutting, removing, and baking so it has become an unsuccessful machine.[8]

B. Semi-Automatic Rotti Making Machine with Single Roller and supporting plate:

Fig.2 Semi-automatic rotti making machine with single roller and supporting plate

In this machine also the flour is mixed separately and made a dough. Several rolls from the dough are made and a single roll of dough is kept on the base plate by covering two plastic at the upper and lower surface of the rolls. When the machine is get started a roller is pressed over the dough and the base plate will get start rotating. Due to the rotating action of the base plate and the pressing roller, a thin sheet in the shape of rotting is formed and this round-shaped rotti is removed by hand, baked separately on the tava.

C. Semi-Automatic Mass Production Rotti Making Machine:

Fig.3 Semi-automatic mass production rotti making machine

This machine will also work the same as those of those two machines but here a maximum number of rotties are produced with a minimum amount of time. So that it is named as a mass production rotti machine. When the motor is switched on rollers, the cutter and conveyor will start, and the atta is pushed by hand in between the two rollers which are made from acrylic material. The atta between the two rollers comes out in the form of a sheet and starts moving by the conveyor and the cutting is done by rotating cutter which is round, in this machine for cutting purpose, 2-3 cutters are attached to the rotating rollers, when this roller with cutters (of round shape) moves on the sheet of flour the sheet will get cut in the round shape thus the cutting action will get the finish. Within an hour nearly 1000 roti's are made by this machine. The cut pieces of rotties are collected on the tray. The collected rotties are removed by hand and heated on a tava separately. By this, the process will wind off.[9]–[12]

III. DESIGN AND ASSEMBLY OF ROTTI MAKING MACHINE

A. Major Steps in Building the Assembly:

Add a part into an assembly by following the steps

- Insert
- Existing component with positioning
- Click on product
- Select the required part from the file
- Then the part will appear on the assembly workbench
- Repeat this procedure to bring the parts which are already created
- Fix create constraints between this new part and other parts by using various constraints like offset, coincidence, angular constraints, etc.

Then a complete assembly which can also be specified and called a product is being formed as shown in below Fig.4

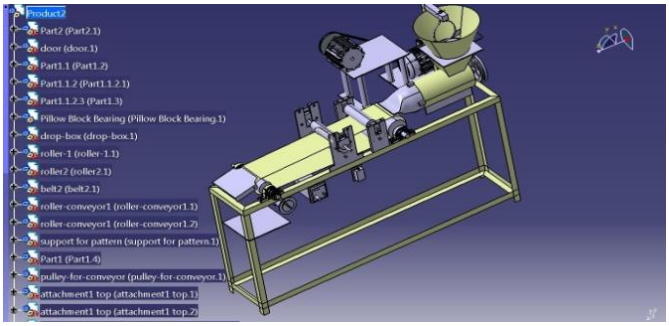

Fig.4 Assembly of unbaked rotti making machine

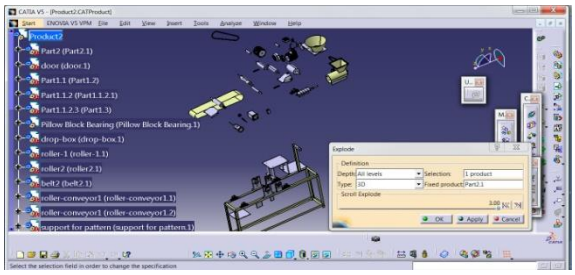

Fig.5 Exploded view of the assembly

B. Bill of Materials

Table.1 Bill of Materials

QUANTITY	PART NUMBER	TYPE	NUMBER
1	Stand	part	1
1	Opening and closing panel	part	2
1	Roller 1	part	3
1	Hopper	part	4
1	Screw feeder	part	5
1	Pedestals	Assembly	6
1	Cylinder with dropbox	part	7
1	Conveyor driven roller	part	8
1	Conveyor driver roller	part	9

2	Conveyor	Assembly	10
1	Supporting roller for cutter	part	11
1	Roller with cutter	part	12
1	Mountings on frames	part	13
2	Gear reduction motor	Assembly	14
1	Blade	part	15
1	S F driver pulley	part	16
1	S F driven pulley	part	17
1	Pulley with belt	Assembly	18
1	A C motor	part	19
1	Shaft for gearbox	part	20
1	Regulator	part	21
1	Switch	part	22
1	A shaft of dc motor	part	23
1	D C motor	part	24
1	Conveyor driver pulley	part	25
1	Belt for conveyor	part	26
1	Tray	part	27

IV. FABRICATION OF ROTTI MAKING

A. Blade or Atta Kneader :

The blade used here is in the form of an elliptical, which is made up of steel material when the motor is switched on the blade will start rotating and a mixing action will take place due to the rotation of the blade inside the hopper. The shape of the blade is elliptical, which makes flour to stir and make mixing well, thus smooth dough is made.

Fig.6 Fabricated mixing blade/atta kneader

B. Hopper

Hopper is made up of an aluminum sheet that is bent and connected in a conical frustum shape, having the capacity to mix up to 10 kg of flour. The bottom hole provided will act as a source of transformation. When the hole is operated by the opening and closing panel, the dough at the bottom side will get accumulated in the dropbox.

Fig.7 Fabricated hopper

C. Opening and Closing Panel

The smooth dough which was formed by mixing the atta and water in the hopper is dropped due to the gravity into the dropbox of the square funnel, by opening and closing panel which is made up of mild steel plate and is provided with a handle which is placed in between the hopper and the drop box at a distance of 20 cm. During mixing it is in the closed position. After mixing it allows the mixed dough to flow into the dropbox.

Fig.8 Fabricated opening and closing panel

D. Drop Box

The dropbox is made up of mild steel material in square frustum shape is attached to the screw feeder cylinder permanently by the welding process. The dough formed in the hopper will get collected in the dropbox, from where the dough is forced to accumulate in the feeder cylinder.

Fig.9 Fabricated dropbox

E. Screw Feeder

The screw feeder which is made up of stainless steel is fixed inside the cylinder made up of mild steel. The screw feeder is having six screws on the shaft. The cylinder is fixed on the stand by the welding process. When the motor is switched on the shaft of the feeder is driven by the motor and the pulley will start rotating. So the dough will start moving in the forward direction and pass through the nozzle of the screw feeder cylinder.

Fig.10 Fabricated screw feeder

F. Screw Feeder Cylinder

The dough which was dropped into the drop box will get accumulate in screw feeder cylinder by applying pressure on the dough it will get feed completely in the screw feeder, the screw which is made up of steel material will be rotated by the motor will push the dough, that dough will get accumulate in the nozzle which is provided at the front face of the screw feeder cylinder made up of steel material will make the dough to come out of it in the form of smooth sheet, the thickness of this sheet can be increased or decreased by reducing the thickness of the rectangular nozzle. A screw is provided over that nozzle to adjust the thickness of the outcoming sheet and the sheet thickness provided here is 2 mm.

Fig.11 Fabricated cylinder of screw feeder

G. Nozzle

The nozzle shown in fig is completely made of stainless steel, which is bent in the shape of bowl, tapered, and rectangle shape. When the dough is forced by the feeder, the dough will get accumulates firstly in the tapered shape bowl where due to the

creation of positive pressure the dough will come out in the form of a sheet from the rectangle gap (2 mm gap) provided at the in front of the nozzle.

Fig.12 Fabricated nozzle

H. Cutter with Supporting Roller

The cutter which is driven by the motor on the conveyor is made up of mild steel material. The roller diameter is 60mm and the cutter is having a diameter of 180 mm. This is held on the conveyor by the frames made up of mild steel, which are fixed on the stand of the machine.

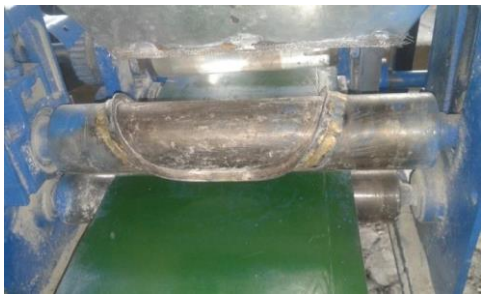

Fig.13 Fabricated cutter with supporting roller

I. Conveyor with Roller

The conveyor used here is a regular rubber conveyor, two rollers are covered by this conveyor, and rollers are made up of mild steel material fixed on the stand with the help of a pedestal with bearing. When the motor is switched on rollers with the conveyor will start moving. The rotation of the conveyor can be regulated by using the regulator. Which transfer the sheet came out from the nozzle to the cutter, from where the cutting action will take place after that it will again transfer the cut portion (rotti) on the tray.

Fig.14 Fabricated roller with conveyor

J. Rotti Collecting Tray

The tray used here is made up of steel having a gauge thickness of 20mm. This is completely fixed without any gap to the conveyor by two nuts and the rotties are collected on the tray which is transferred by the conveyor.

Fig.15 Fabricated rotti collecting tray

K. Pedestal with Bearing

The figure shows the Pedestals which are also known as pillow blocks. These are the most common mounting for holding the roller bearing. These pedestals should be fully supported on a flat, rigid surface to avoid distortion of the pedestal or deflection under the load. The maximum safe radial load on the pedestal is based on the static rating of the corresponding size of roller bearings. These pedestals are made up of mild steel.

Fig.16 Fabricated Pedestal

L. Pulley arrangement for cutter and roller with conveyor system

Fig.17 shows the arrangement of pulleys for the screw feeder. Were the smaller pulley acts as a driver pulley which is driven by a dc motor, and the larger pulleys act as a driven pulley. Both are connected using B-20 v belt having a height of 11mm and width of 17mm .when the motor is turned on the smaller pulley, which is attached to the dc motor will start rotating, due to the rotation of the driver pulley driven pulleys will also start rotating with the help of V belt having a length of 180mm. So that the electrical power from the dc motor is converted into mechanical power, which in turn runs the mechanical components. Which are a cutter, roller with a conveyor.

Fig.17 Fabricated pulley with V belt

M. Pulley arrangement for screw feeder system

Fig shows the pulley arrangement for the screw feeder. The smaller pulley which acts as a driver is rotated by the reduction gearbox connected by the regular ac motor. When the motor is turned on, the number of rpm from the motor having 1440 will get reduces to 110 to 150 rpm by the reduction gearbox. So that the rpm of the screw feeder will get reduced. And also there is a facility for the screw feeder to move forward and reverse by controlling the switch.

Fig.18 Fabricated pulley arrangement for screw feeder and reduction gearbox with v belt

N. Stand

Fig.19 shows the stand with roller and conveyor arrangement. The whole body of this is made up of mild steel material to withstand the weight of overall components. Two frames are attached to the stand by welding for holding cutter and rollers. Four pedestals are used to hold the conveyor rollers.

Fig.19 Complete stand with their mountings

O. Dough Kneader with Hopper

Fig.20 shows the dough kneader with a hopper, which is one of the major components of the machine, acts as an atta mixer.

Fig.20 Fabricated hopper with a blade

P. Screw Feeder with dropbox and pulley arrangements

Screw feeders are designed to measure several materials and are typically placed at the mainspring of a process. Screw feeders are available in a variety of sizes, lengths, configurations, and materials for fabrication. The inlet of a screw feeder is always heavily loaded and a screw feeder is typically always seated directly to the hopper.

Fig.21 Fabricated screw feeder cylinder with dropbox

Q. Conveyor with roller and cutter

Conveyor systems are a common piece of mechanical handling accessories that moves materials from one place to another. For the continuous transportation of material belt conveyors are used in the transport of coal and mineral powder it gives high efficiency and environmental protection. In some cases, according to the requirement if we increase conveyor inclination up to 170 to 180 the impact on the whole assembly of shaft occur due to this impact of material on the conveyor shaft it breaks or bends within a few months. By using design failure modes and effects analysis for a systematic, proactive method for identifying where and how it might fail.

Fig.22 Fabricated rollers with conveyor

V. WORKING PRINCIPAL

A. Completely Fabricated Unbaked Rotti Making Machine

Fig.23 shows the completely fabricated unbaked rotti making machine. This is having the capacity to make nearly 1200-1300 Rotties within an hour.

Fig.23 Unbaked rotti making machine

B. Working Principle Of Rotti Making Machine:

When the motor or power supply is switched on the blade which is driven by the motor will start rotating at about 50 to 60 rpm, here the rotating blade is made up of a steel rod. Due to the rotation of a blade, the atta with water will get mixed and forms dough in the hopper.

Hopper is a stationary part that is fixed at a distance of 10m from the machine base. The hopper is made up of an aluminum sheet that looks like a conical frustum and the bottom face of this is provided with an opening and closing mild steel plate thick plate having a thickness of 20cm. It is a place where the atta and water will get mixed thoroughly due to the rotation of a blade, the maximum capacity that is it can mix the atta up to the value of 10kg. The atta will get mixed completely and form a smooth dough.

The smooth dough which was formed by mixing the atta and water in the hopper is dropped due to the gravity into the dropbox of the square funnel, by opening the mild steel plate which is provided with a handle, placed in between the hopper and the drop box at a distance of 200 mm. The dough which was dropped into the dropbox, will get accumulate in screw feeder cylinder by applying pressure on the dough it will get feed completely in the screw feeder, the screw which is made up of steel material will be rotated by the motor will push the dough, that dough will get accumulate in the nozzle which is provided at the front face of the screw feeder cylinder made up of steel material will make the dough to come out of it in the form of smooth sheet, the thickness of this sheet can be increased or decreased by reducing the thickness of the rectangular nozzle. A screw is provided over that nozzle to adjust the thickness of the outcoming sheet and the sheet thickness provided here is 2mm. The smooth sheet of dough which is made up of atta and water mixture will be moved/passed by the leather conveyor rotated by the regulator dc motor, as the conveyor starts rotating by operating the forward and reversing control switch, the conveyor will carry this sheet up to a certain distance after that the sheet will undergo the cutting action by the rotating roller made up of a mild steel rod which is also rotated at the same speed as that of a conveyor speed, the cut portion of sheet forms a round rotti and the diameter of the final rotti is 180mm.

VI. RESULTS AND DISCUSSION

As this machine was designed for preparing all the varieties of rotties, the ratio of mixing the water with a different kind of atta will also change. If the speed of the conveyor is regulated correctly i.e. same as that of screw feeder speed the final product will be good. Improper maintenance of the speed will try to affect the final output (rotti). So it's very important to maintain the speed of the conveyor and screw feeder. Here the speed of the screw feeder is fixed, thus it's very important to match that speed by regulating the conveyor speed by the regulator.

The final output of the product from this machine is are Jowar roti, Daal rotti, Bajra rotti, Rice rotti, and Chapati. All these types of rotties and chapatti's are made by using a single machine named as 'Unbaked Rotti Making Machine'. For this an extra heating process can be added by placing the heater at the bottom face of the machine or else by placing another steel conveyor at the bottom face of the stand for heating, the steel conveyors have to be mounted with the burners or else simply placing the stoves below the steel conveyor.

VII. CONCLUSION

1. The fabrication of rotti making machine was more innovative and challenging because of the least reference material availabilities.
2. The successful results show the proper design and fabrication of roti production unit after the trail runs.
3. The rate of rotti production is much more compared to manual.
4. It can be concluded that the machine designed is having a capacity to produce nearly 20 to 22 rotis per minute, which means within an hour this machine will produce or make nearly 1000 to 1200 rotties.
5. All the maintenance and cleaning will be done by using water with cotton clothes.

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