International Journal of Current Engineering and Technology
E-ISSN 2277 – 4106, P-ISSN 2347 – 5161

Available at http://inpressco.com/category/ijcet

Research Article

Design and Assembly of Rotti Making Machine using CATIA V5

Menaka Muchhetti†, Samatham Madhukar † and D Sai Suman† and Nithin Chandra Manas †

†Assiatant Professor, Department of Mechanical Engineering, Lords Institute of Engineering and Technology, Osmania University, Telangana, TS, India.

Received 27 Oct 2021, Accepted 25 Nov 2021, Available online 30 Nov 2021, **Vol.11, No.6 (Nov/Dec 2021)**

Abstract

Flatbread is 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 design a machine that can make all the varieties of rotti's and chapatti. The design of roti making machine was more innovative and challenging because of the least reference material availabilities. In the current work, all the parts which are used in fabrication are designed and then assembled in catia V5 to verify the functionality of the machine.

Keywords: *Rotti Maker, Catia V5, modeling, Drafting, Assembly, Extruded View*

1. 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 for many years, it rapidly gaining importance for their nutritional and health benefits. (Kumar *et al*., 2017) 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 as sorghum has a great amount of calcium, it also comprises iron, magnesium, and fiber it also lowers cholesterol levels and other health benefits are as follows:(Daspute *et al*., 2020; Gurushree *et al*., 2011; Macdonald, 2021)

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 more 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 as well as additionally jowar contains traces of zinc, copper, and over 20 micronutrients as well as a high level of antioxidants.(Ankamma *et al*., 2020; Daspute *et al*., 2020; Macdonald, 2021; RichardsonR, 2018; Tamboli, 2017)

*Corresponding author's ORCID ID: 000000346675129
DOI: https://doi.org/10.14741/ijcet/v.11.6.5

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. (S. Madhukar *et al*., 2017; Samatham Madhukar *et al*., 2017; Madhukar† *et al*., 2018; Prashanth Naik *et al*., 2020)

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

Contents	Jowar 1cup
Calories	651 kcal
Carbohydrates	143g
Protein	21.7g
Fiber	12g
Fat	6.3g
Magnesium	316.8g
Phosphorous	551g
Potassium	672g
Calcium	53.8g
Iron	8.4g

2. Survey on Existing Machines

Various Surveys Done On Existing Rotti Making Machine:

2.1 Semi-Automatic Portable Unbaked Rotti Making Machine:

Fig.1 Semi-automatic portable unbaked roti making machine

The machine shown in Fig.1 is a semi-automatic unbaked roti-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 roti 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 roti 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 people are involved in mixing, pressing, cutting, removing, and baking so it has become an unsuccessful machine.

2.2 Semi-Automatic Rotti Making Machine With Single Roller and supporting plate:

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

In this machine also the flour is mixed separately and made a dough. The number of roles from the dough is 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 role. 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.

2.3 Semi-Automatic Mass Production Rotti Making Machine:

Fig.3 Semi-automatic mass production roti 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 a 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 baked on a Tava separately. By this, the process will wind off.

3. Part Design and Drafting the Different Components of Rotti Making Machine

3.1 Drafting

Drafting involves breaking down complex, difficult ideas into simple, representational lines. This process parallels the way our brains interpret and simplify the huge amount of visual information our eyes receive. A drafter's goal is to make a drawing as readable as a book to people trained in interpreting drawings. These people have different backgrounds; they include designers, contractors, subcontractors, owners, vendors, lenders, and others. Making drawings readable to members of these groups is facilitated by following industry conventions and standards, the most common being the Uniform Drawing System (UDS) devised jointly by the American Institute of Architects and the Construction Specifications Institute. However, these conventions can only be discussed at a general level, because each company has its own set of drafting standards. A protocol you learn in one office may be different in another. However, such protocols are never so different that you would not be able to infer what a differently-drafted label or symbol means as long as you understand the label or symbol in the first place. Whenever a person begins a new job in designing he/she must and should study drawings of the office's past projects to learn that office's specific conventions. Companies often provide a handbook of drafting graphic standards for their designers to follow.
Steps involved in drafting:

1) Open the part which you have to do the drafting
2) By keeping that part opened, go to the start, mechanical design, and drafting than a dialogue box appears which looks to be

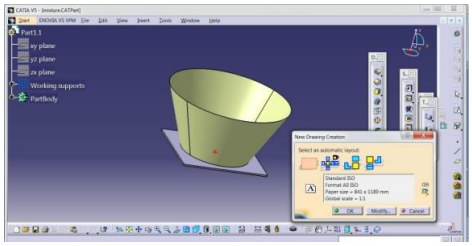

Fig.4. Drafting Of Hopper

3) Click ok if the sheet requirement is the same as that of from the dialogue box that appeared, or else if you want to modify then click on modify and select the required page size.
4) Click on ok from the dialogue box the main page of the drafting appears which looks to be

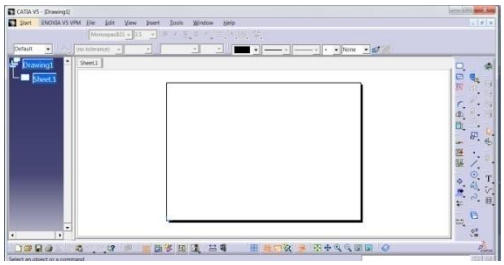

Fig.5. Main Page Of The Drafting

5) After getting the sheet, set the sheet size by following the steps

- ↓ Edit
- ↓ Sheet bag round
- ↓ Insert
- ↓ Drawing
- ↓ Frame and title block
- ↓

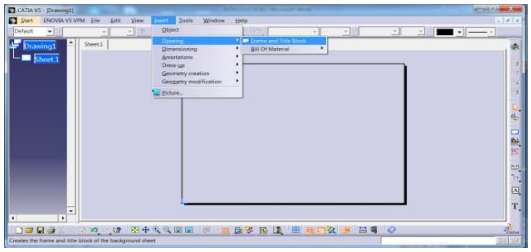

Fig.6. Paper Size Setting Dialogue Box

•Then a dialogue box will appear.

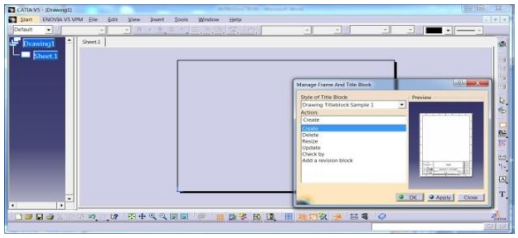

Fig.7. Dialogue Box After Page Set

- Click ok then a sheet with frame and title block will appear on the screen, which looks

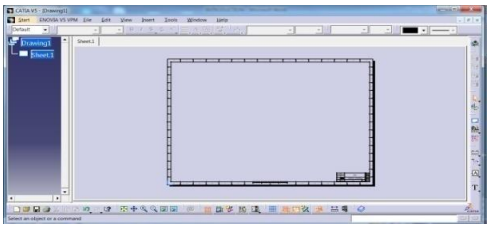

Fig.8. Frame And Title Block On The Screen

• Again go to the edit working views than the actual working sheet for making the drafting will appear. In that various views of the part and their dimensioning will be made by using views and dimensioning etc.

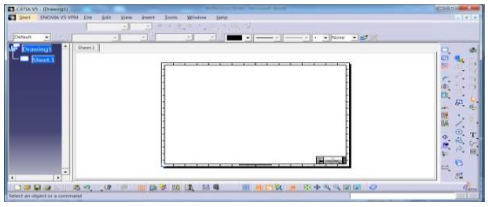

Fig.9. Actual Working Sheet

- Know the sheet is ready to start inserting the part which was already opened for that click on insert

↓ Views
↓ Front view
↓ Select the required part
↓ Click on that part.

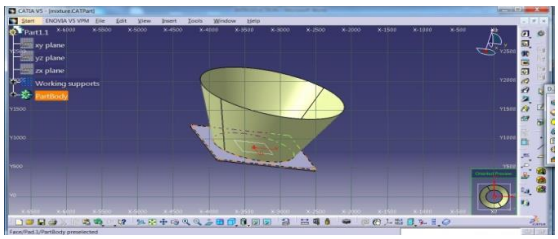

Fig.10 Inserting of work part

- It will directly change the workbench and appears on the drafting workbench from the assembly.

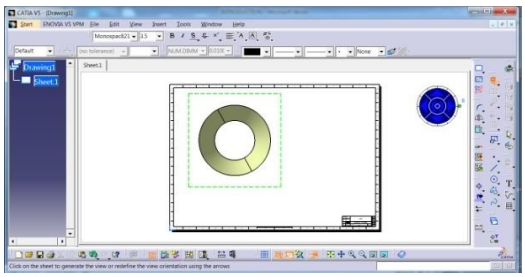

Fig.11. Drafting Work Bench After Inserting Part

- Adjust the position by using the compass and also you can change the scale and other parameters by changing their properties.
- Now draw the various views by selecting the projection views by which show various views, formed on the sheet.

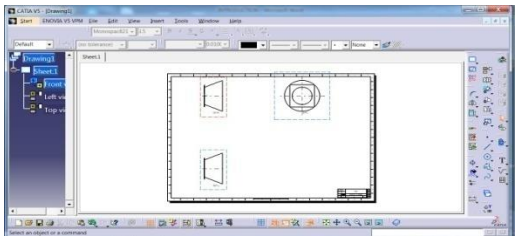

Fig.12. Projected Views of Hopper

- Then generate the dimensions by using the dimension tool

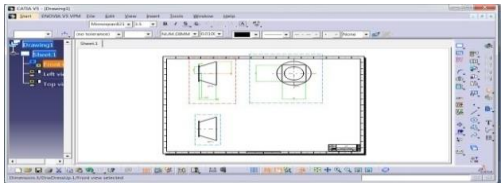

Fig.13. Dimensioning of Hopper

- If is there any cut sections, brake parts, etc are also be shown by using the various tools. Thus finally the procedure of drafting will finish off. Thus save the file.

3.2 Hopper

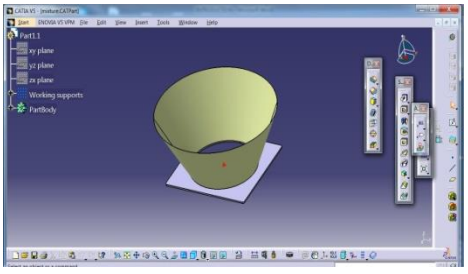

Fig.14. Surface Modeling 0f Hopper

3.3 Dough kneader with hopper

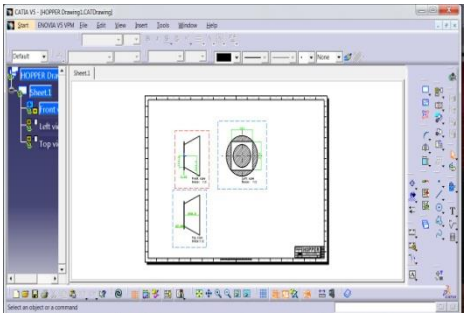

Fig.15. Drafting of Dough Kneader with Hopper

Maximum diameter = 406mm
Minimum diameter =228mm
Height of the mixer=203mm
Square sheet dimension attached to the minimum diameter end=290 x 290mm
Closing and opening plate dimension = 280 x 290mm
Length of mixing blade=230mm
Motor= 100-120 rpm
Blade thickness= 10mm

3.4 DropBox

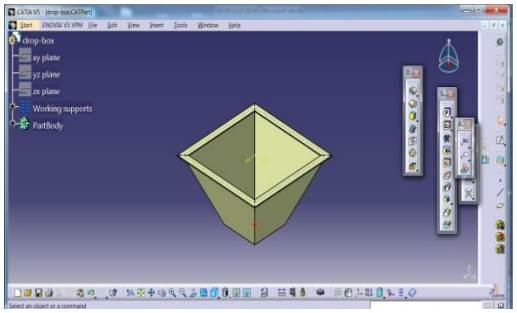

Fig.16. DropBox

3.5 Screw feeder cylinder with dropbox and pulley arrangements:

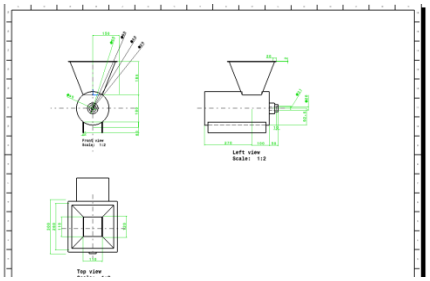

Fig.17. Views of Screw Feeder Cylinder with DropBox

3.6 Screw Feeder Cylinder

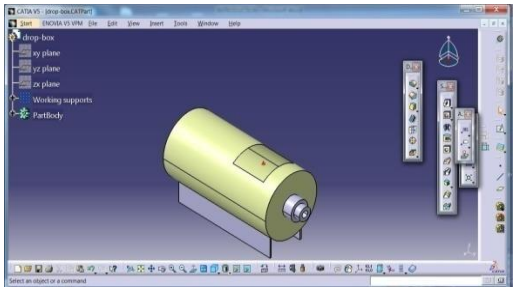

Fig.18. Surface Modeling of Screw Feeder Cylinder

Dimensions of the screw feeder cylinder with drop box:
Screw feeder cylinder:

Bore diameter=185mm
Cylinder length =270mm
Overall length=420mm
Base stand dimension=60mm x 310mm

Dropbox:

Major square hole dimension= 300 mm x 300mm
Minor square hole dimension= 110 mm x 110mm
Height of the drop box=185mm
Overall width of the major square hole=300mm

3.7 Screw Feeder

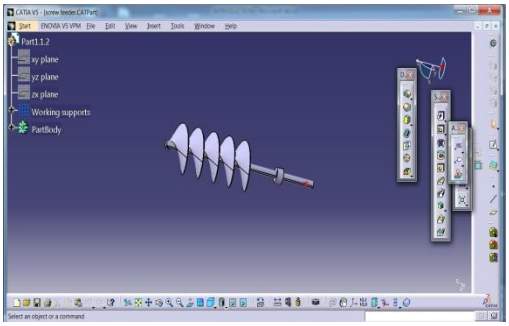

Fig.19. Surface Modeling of Screw Feeder

3.8 Drafting of Screw Feeder

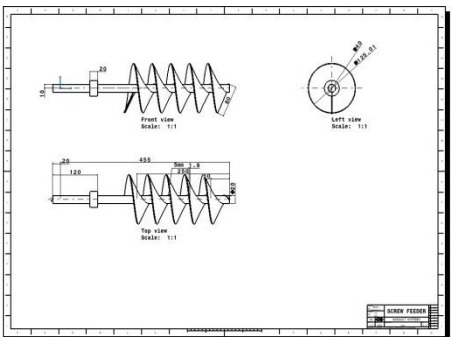

Fig.20. Views & Dimensions Of Screw Feeder

Dimensions of the screw feeder:

No of blades= 5
Rod diameter=20mm
The overall length of the rod=475mm
Pitch of the screw=250mm
The thickness of the blade =1.8mm
Diameter of the screw blades =125mm

3.9 Nozzle

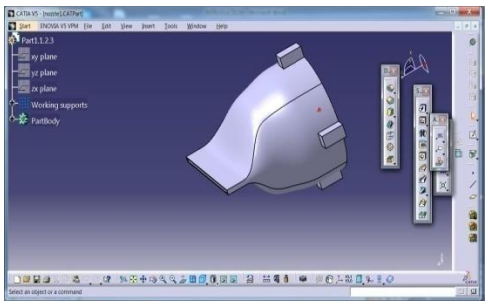

Fig.21. Surface Modeling Nozzle

3.10 Drafting of Nozzle

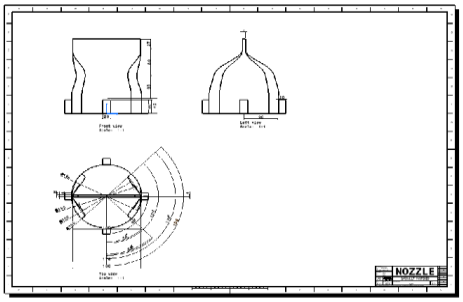

Fig.22. Drafting of Nozzle

Dimensions of nozzle:

The first diameter of the nozzle=185mm
Second diameter of the nozzle=180mm
Third diameter of the nozzle=160mm
Fourth diameter of the nozzle=150mm
Length of the nozzle=217mm
Width of the nozzle=180mm
The gap between the two faces=2mm
Height of the check=40mm
Width of the check=20mm
The thickness of the check=20mm

3.11 Conveyer with Roller

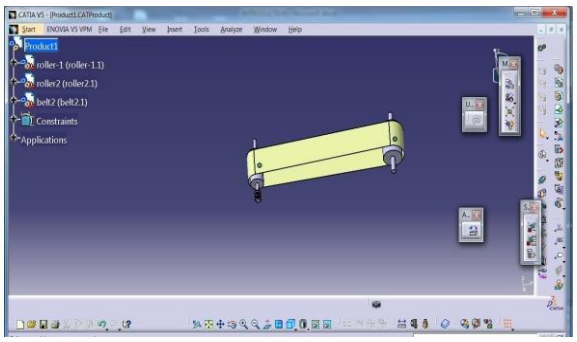

Fig.23. Part and Surface Modeling of Roller With Conveyer

3.12 Drafting of Conveyer with Roller

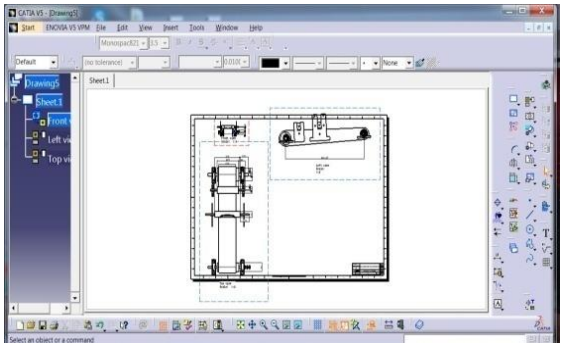

Fig.24. Views of Conveyor with Roller

Major Dimensions:

Major roller diameter=130mm
Minor roller diameter=90mm
Length of the rollers=260mm
Roller shaft diameter=30mm
Shaft length=150mm
Length of the conveyor=950mm
Width of the conveyor=210mm
Thickness of the conveyor=2mm

3.13 Cutter with Roller

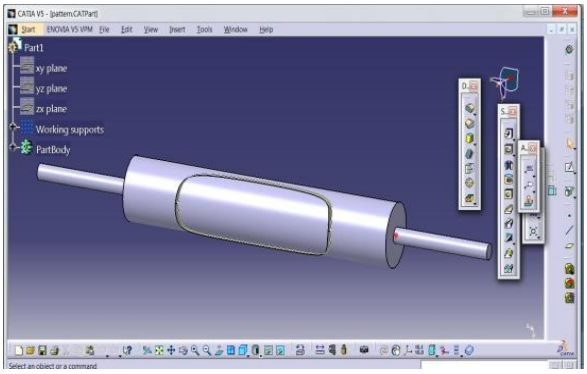

Fig.25. Part and Surface Modeling of Roller With Cutter

3.14 Drafting of Cutter with Roller

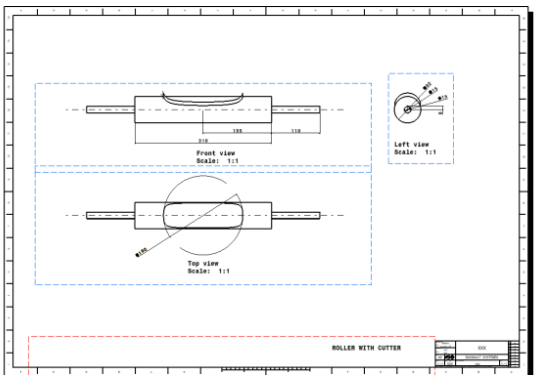

Fig.26. Drafting of Cutter with Roller

3.15 Supporting Roller for Cutter

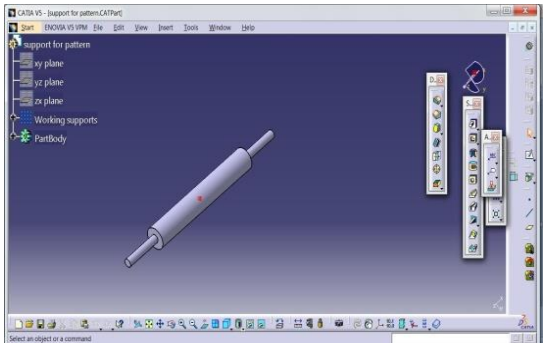

Fig.27. Part Modeling of Supporting Roller for Cutter

3.16 Drafting of Supporting Roller for Cutter

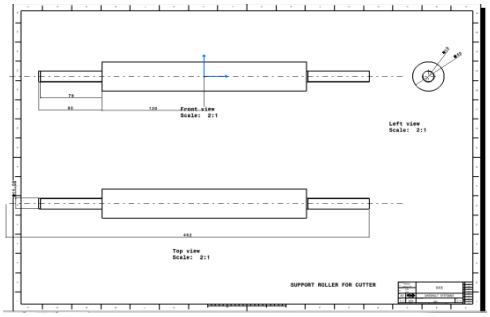

Fig.28. Drafting of Supporting Roller for Cutter

3.17 DC Motor

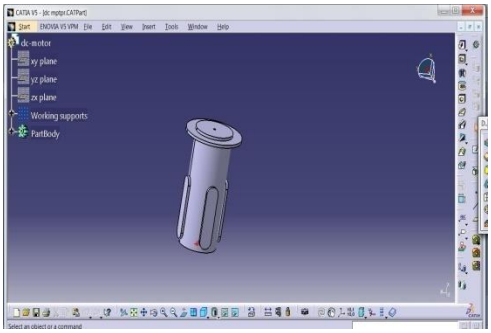

Fig.29. Part Modeling of DC Motor

3.18 Drafting of DC Motor

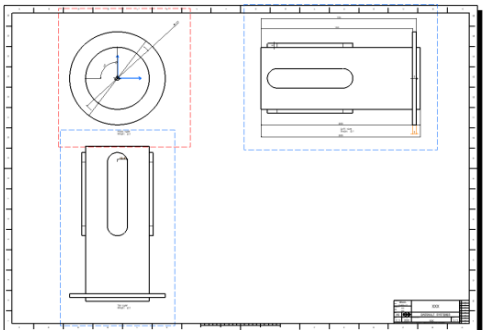

Fig.30. Drafting of DC Motor

3.19 Regulator

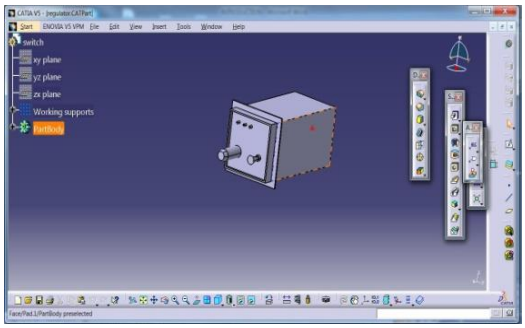

Fig.31. Part Modeling of Regulator

3.20 Drafting of Regulator

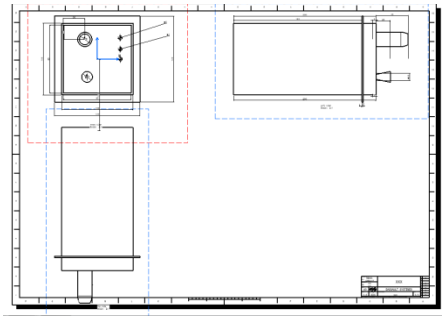

Fig.32. Drafting of Regulator

3.21 Switch

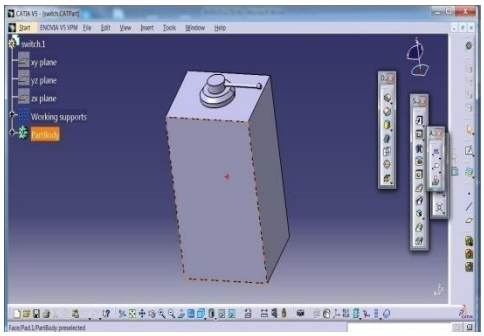

Fig.33. Part Modeling of Switch

3.22 Drafting of Switch

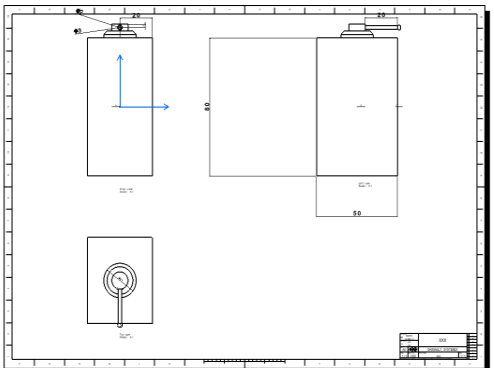

Fig.34. Drafting of Switch

3.23 Blade for Mixer

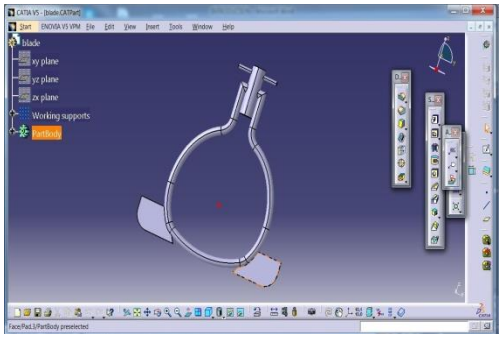

Fig.35. Part Modeling Of blade

3.24 Drafting for Blade for Mixer

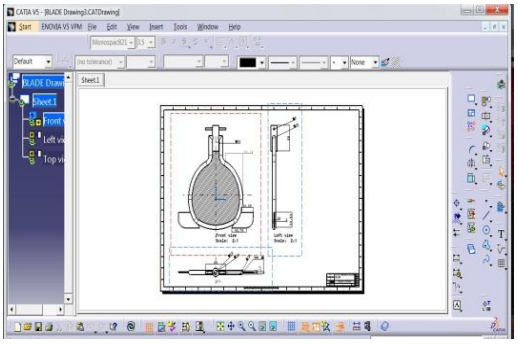

Fig.36. Drafting for Blade for Mixer

3.25 Roti Collecting Tray

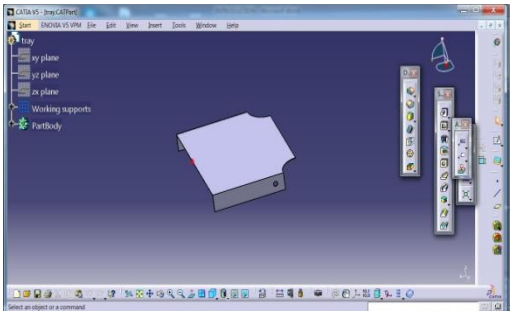

Fig.37. Part Modeling of Roti Collecting Tray

3.26 Drafting of Roti Collecting Tray

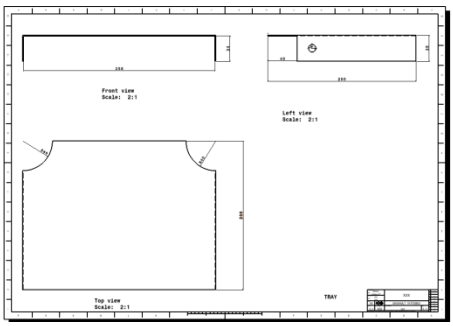

Fig.38. Drafting of Roti Collecting Tray

3.27 Opening and Closing Panel

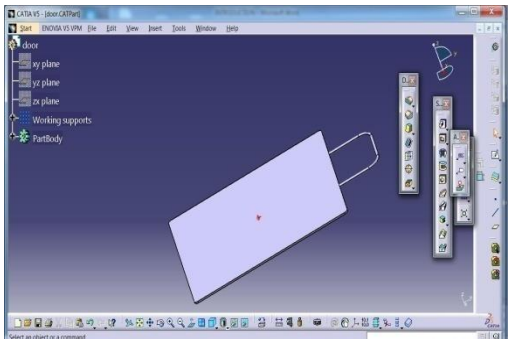

Fig.39. Part Modeling of Opening and Closing Panel

3.28 Drafting for Opening and Closing Panel

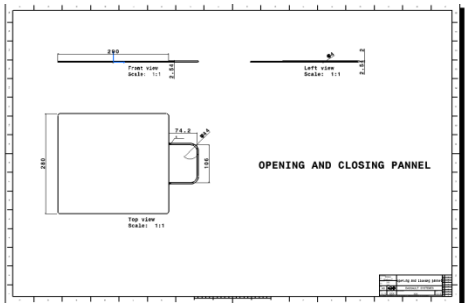

Fig.40. Drafting for Opening and Closing Panel

3.29 Pedestal with Bearing

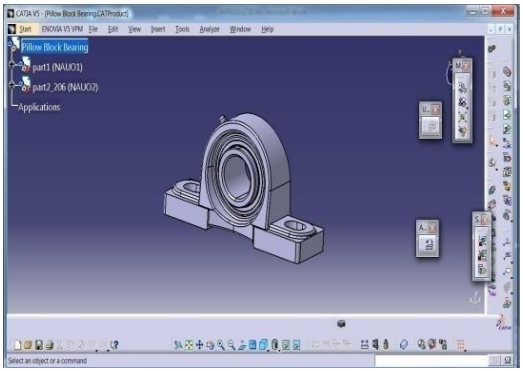

Fig.41. Part Modeling of Pedestal with Bearings

3.30 Drafting of Pedestals on the stand

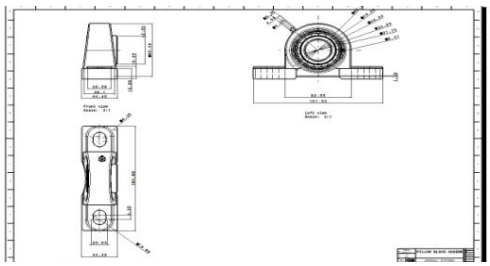

Fig.42. Drafting of Pedestals on the stand

3.31 Frames used for Holding the Supporting Roller and Cutter:

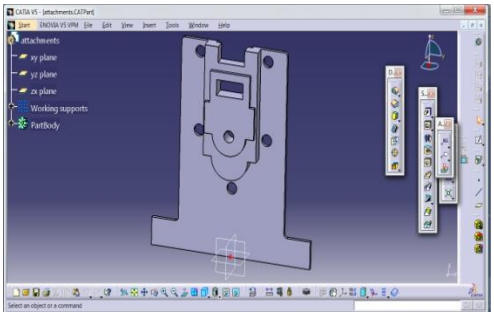

Fig.43. Part Modeling of Frame for Holding Supporting Roller

3.32 Drafting of supporting frame for the rollers on the stand:

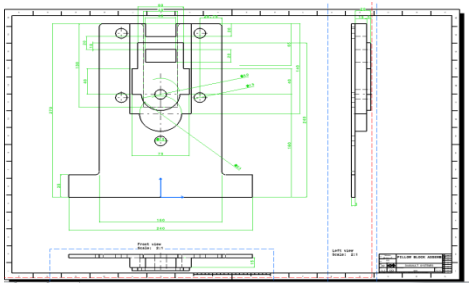

Fig.44. Drafting of Frame For Holding Supporting Roller

3.33 Frames used for holding the rollers

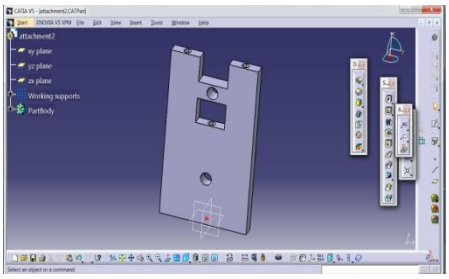

Fig.45. Part Modeling of Pedestal With Bearing

3.34 Drafting of supporting frame for the cutter on the stand:

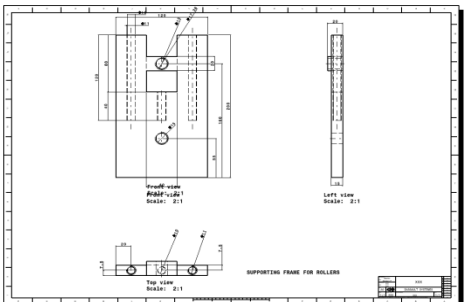

Fig.46. Drafting of supporting frame for the cutter on the stand

3.35 Bowls for Sprinkling The Loose Atta:

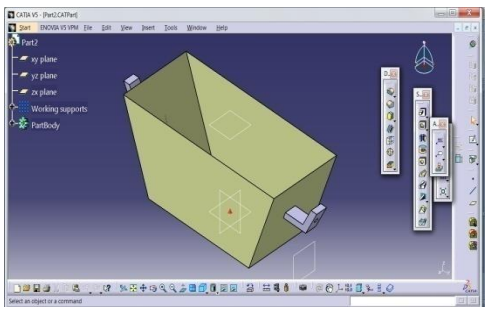

Fig.47. Surface Modeling of Bowls For Sprinkling The Loose Atta

3.36 Drafting of Vibrating Bowl

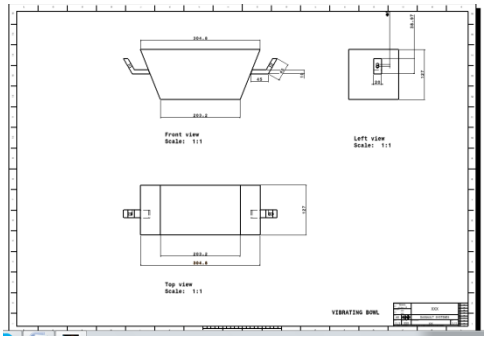

Fig.48. Drafting Of Vibrating Bowl

3.37 Part design of conveyor roller 1

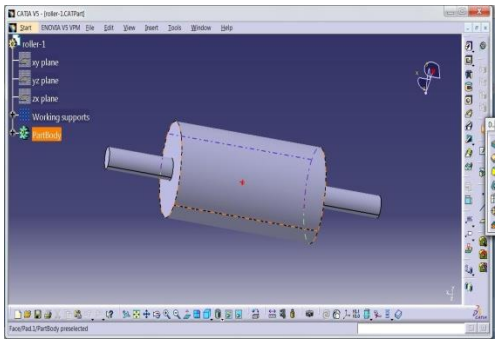

Fig.49. Part Modeling of Roller 1

3.38 Drafting of conveyor roller 1

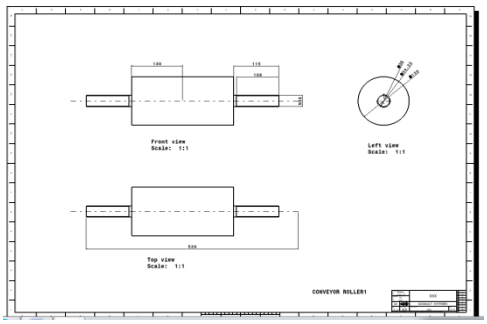

Fig.50. Drafting of conveyor roller 1

3.39 Part design of conveyor roller 2

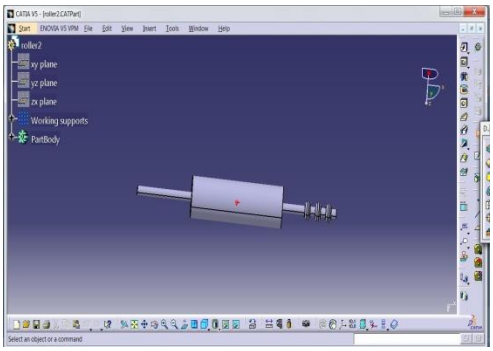

Fig.51. Part design of conveyor roller 2

3.40 Drafting conveyor roller 2

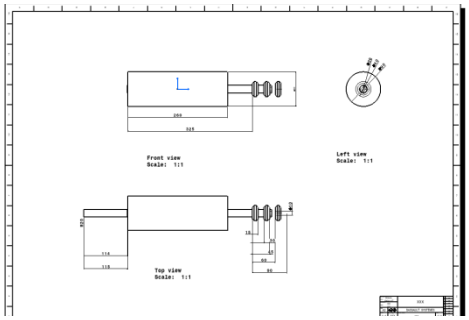

Fig.52. Drafting conveyor roller 2

3.41 Stand

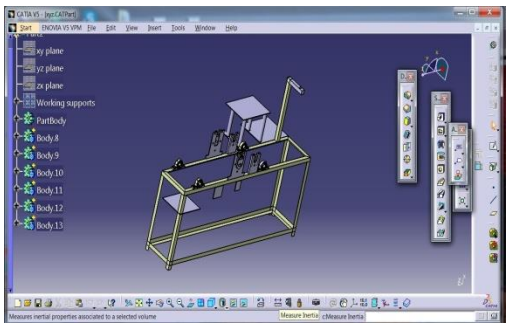

Fig.53. Part And Surface Modeling Of Stand

3.42 Drafting of Stand

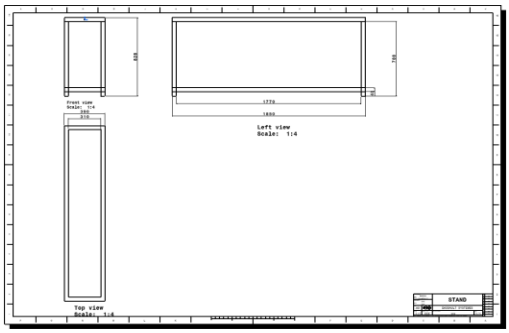

Fig.54. Drafting of Stand

3.43 Different Views of The Machine:

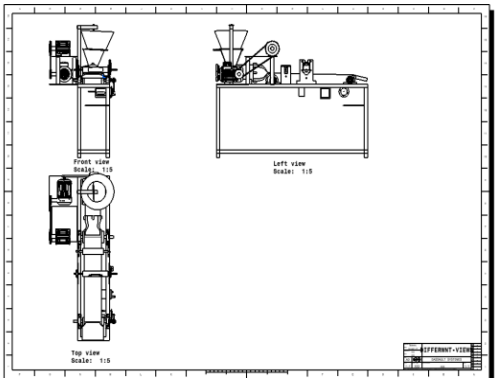

Fig.55. Views of The Machine

Major Dimensions:

Length of the stand=1850mm
Height of the stand =828mm
Width of the stand=390mm
Screw feeder height from the base=910mm
Hopper height from the base=1214mm
Mixing blade height from the base=1450mm
Nozzle height from the base=886mm

3.44 Pulley Arrangement For Cutter And Roller With Conveyor System:

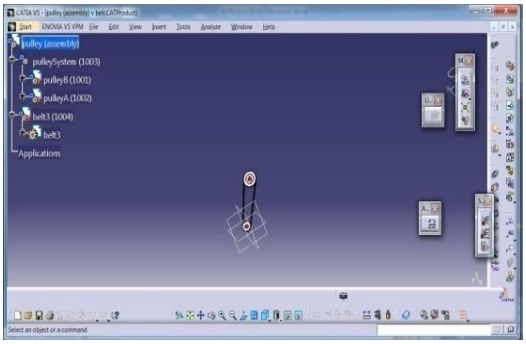

Fig.56. Assembly of Pulley and belt Arrangement for cutter and roller

3.45 Pulley Arrangement For Screw Feeder System:

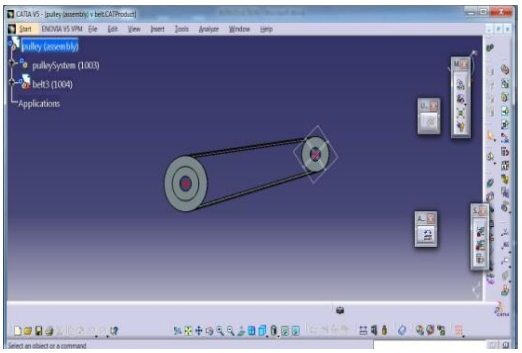

Fig.57. Assembly of Pulley and belt Arrangement for screw feeder system

3.46 AC Motor With Reduction Gearbox:

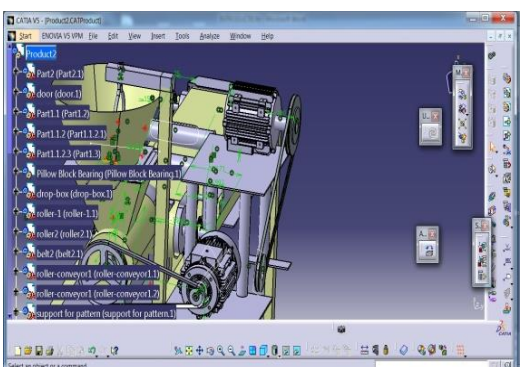

Fig.58. Assembly of AC Motor With Reduction Gearbox

4. Bill of Materials: Rotti Making Machine

Different parts: 40
Total parts: 50

Table.2 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	The shaft of dc motor	part	23
1	DC motor	part	24
1	Conveyor driver pulley	part	25
1	Belt for conveyor	part	26
1	Tray	part	27

5. Assembly Design

5.1 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

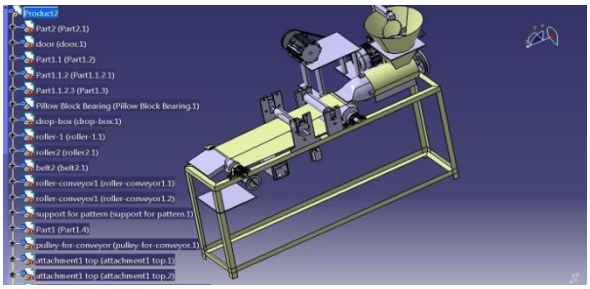

Fig.59. Assembly of unbaked roti making machine

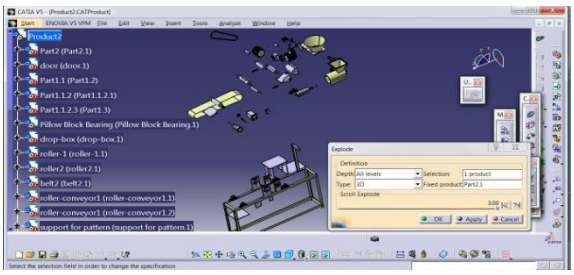

Fig.60. Exploded View Of The Assembly

Conclusions

1. The design of roti making machine was more innovative and challenging because of the least reference material availability.
2. The successful results show the proper design and fabrication of the rotti production unit.
3. The rate of rotting production is much more as compared to manual production.
4. It will 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 can produce or make nearly 1000 to 1200 rotties.
5. The main drawback/disadvantage of this machine is that it involves more no. of components, regular maintenance and cleaning is compulsory after usage. The cleaning of the hopper, conveyor, and other parts is easier, but the cleaning of the screw feeder is very complex due to the blades, as it pushes the dough, some portion of the dough will get stuck to the screws which are not easier to clean.
6. All the maintenance and cleaning will be done by using water and cotton clothes.

References:

Ankamma, K., Reddy, K. S., & Babu, A. M. (2020). *Design of Prototype Automatic Curry Making Machine*. *16*(10), 248–

257.

Daspute, A., Kapse, R., Gurule, S., Sadgir, K., & Deore, P. M. A. (2020). *Multitasks performing machine*. *4*(5), 391–393.

Gurushree, M. N., Nandini, C. R., Pratheeksha, K., Prabhasankar, P., & Hosamane, G. G. (2011). Design, development, and performance evaluation of chapatti press cum vermicelli extruder. *Journal of Food Science and Technology*, *48*(2), 218–224. https://doi.org/10.1007/s13197-010-0163-5

Kumar, S., Sriharsha, P., Madhukar, S., Raga, B., & Reddy, H. (2017). *Experimental Investigation on Ceramic Surface Coatings on Aluminum using Detonation Gun Experimental Investigation on Ceramic Surface Coatings on Aluminum using Detonation Gun*. *7*(April), 1–6.

Macdonald, G. K. (2021). *Design and Fabrication of Automatic Squeezing Machine for Food Industries Design and Fabrication of Automatic Squeezing Machine for Food Industries*. https://doi.org/10.1088/1742-6596/2040/1/012013

Madhukar, S., Reddy, B. R. H., Reddy, R. S., & Satyanarayana, V. V. (2017). Experimental investigation of effect of heat treatment on nose radius of insert and temperature at cutting area in turning of titanium (grade 2). *International Journal of Mechanical Engineering and Technology*, *8*(3).

Madhukar, Samatham, Vidyanand, P., Kumar, S., & Jagath, D. (2017). Experimental Investigation on Effect of Heat Treatment on Mechanical Properties of Titanium Alloy (Ti-6Al-4V). In *International Journal of Current Engineering and Technology*.

Madhukar†, S., Harshith Reddy, B. R., Kumar, G. A., & Naik†, R. P. (2018). A Study on Improvement of Fatigue Life of materials by Surface Coatings. *International Journal of Current Engineering and Technology*, *8*(01), 5–9. https://doi.org/10.14741/ijcet.v8i01.10878

Prashanth Naik, R., Samatham, M., Patangay, V. K., & Sree Teja, M. (2020). Experimental Study on the Effect of Annealing on Fatigue Life of SS 304 Steels. *International Journal of Scientific Research in Science, Engineering and Technology*, *7*(1), 164–169. https://doi.org/10.32628/ijsrset207131

RichardsonR, M. (2018). Automatic Chapathi Making Machine. *International Journal of Research and Scientific Innovation (IJRSI) |*, *V*(759), 180–181. www.rsisinternational.org

Tamboli, S. M. (2017). Smart Dough Making Machine. *Imperial Journal of Interdisciplinary Research (IJIR*, *3*(4), 1367–1369.