Multi Die Crank Operated Rice Noodle Maker-A New Product Design
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Abstract—Currently there are different types of rice noodles making machine. One machine is commonly used for low production i.e. for household use. It consists a lead screw which has rotary lever on one end and the plunger on another end and moves through the nut fixed to the frame. This process is very slow and large amount of human force is needed for the extrusion of the noodles out of the rice balls. Another machine consists of wooden press which uses a lever to push the rice balls through the die plate this process is tiresome and very inefficient. Third type of machine is a hydraulic setup purely for commercial purpose but it is very expensive with little greater production rate and having manual feeding and operation.

This paper discusses about a new product developed using product development process to ease the work of extrusion in much lesser price which uses crank operation, has multi die, altered feeding position compared to the conventional machine and is powered by a motor.

Keywords — Die, crank plate, extrusion, rice noodles, rice ball.

I. INTRODUCTION
Rice noodle is the famous dish that is prepared in southern states of India and one of the oldest dishes. It is prepared by making a rice balls from thick dough, steamed in steamer and hot cooked rice balls are put into a pressing machine whose die base has small holes; when pressed by the plunger the rice balls extrudes out of these holes into continuous strands of rice noodles[2]. The dish and the extruding mechanisms are around a century old and the olden machines were made out of wood. After which came the steel framed brass die and plunger.

II. PROBLEM DEFINITION
The conventional rice noodles maker is a manually driven by rotating the power screw into the nut fixed to the frame. This machine is the same for both domestic use and even for the small scale catering service. Where the bigger machine doing same work would be expensive and there is no way that every kitchen could afford the humongous machine, there is no substitute to the conventional machine for domestic purpose.

III. MECHANISM
The new machine carries out the extrusion process using an entirely different mechanism compared to the older machine. It uses crank mechanism where the power from the motor is given to the crank plate after going through the reduction gear. The crank plate will have the crank pin at certain distance from the centre of the crank plate this transmits the motion to the connecting rod which converts he rotary motion of the crank plate into reciprocator motion, the other end of the connecting rod is connected to the plunger which moves freely within the die. The die has the feeding hole on its circumference and at certain height from the base of the die.

IV. DESIGN AND CALCULATION
A. Design of machine
The machine is been designed considering its compactness just like the conventional machine as it can be used for both domestic purpose and small scale food processing industry hence the entire setup is maintained within a boundary of length 1.5 meter width 1 meter and height 0.75 meter.

B. Design of the die
The size of die is slightly larger than the conventional die and it is made of stainless steel. The die has a feeding hole at distance 90mm from the base. The die depth is 150 mm which is slightly
more than the effective stroke length to house the plunger inside die.

**C. Design of plunger**

Plunger is made of stainless steel instead of brass taking cost into consideration. It has a thickness of 10mm and reciprocates inside the die and has a provision for lubrication. The plunger acts as the port by closing and opening the feeding hole.

**D. Design of extruding plate**

Extruding plate is a circular plate of around 2 mm thickness made of brass and small holes of 1.2mm diameter in a circular manner. This is the point where the rice balls converts into noodle strands and extrudes out. It rests in a open ring which can thread fixed to the die.

**E. Design of collecting mechanism**

Collecting mechanism consists of a slender shaft which is driven by the output power of reduction gear via pulley underneath the dies. The ends of the shaft is fixed with rubber wheels these wheels are in contact with circular plate which is pivoted in the bearing.

**F. Selection of the motor**

The motor used here is of wattage 0.18 kW i.e. 0.25hp with a rpm of 1440 and torque of 1.08 Nm which is drives the reduction gear via pulley. It is mounted on the outer frame to avoid any fluid seepage into the motor and causing damage to the motor.

**G. Selection of the reduction gear**

Reduction gear used here is of index 66:1 and having two sided flange output. For the given input of the motor our reduction gear performs with an output speed of 12 rpm and the torque of 31 Nm in the output shaft when it rotates in no load condition. It is mounted at the highest position and the drive from the motor is given through the pulley and belt drive. The belt is of the standard specification of A18.
H. Calculations

Calculations are carried out for the maximum force needed for the extrusion where in practically there will be dynamic loading but the forces are not applied during the time of extrusion; the timing is maintained such that when the maximum load occurs the maximum force is applied for the extrusion.

Motor Power = 0.25HP single phase
Speed = 1440RPM at 200V
Torque from the motor:
P=(2π×N×T)/60
0.25×754.699=2×π×1440×T÷60
T=1.2028Nm
Reduction gear is of worm type
66:1
N2=720/66=10RPM
Torque on one side of the reduction gear
T2'=1.2028×60×2=36.084Nm
Crank plate radius= 80mm
Diameter to Depth ratio=1/2
Distance of the crank pin from the center= 60mm
Diameter of the die= 60mm
Area of the die= π×d^2/4
π×(60)^2/4= 2827.433mm^2
Number of holes on the die base= 160 holes of 1mm
Area of holes= 160×π×1=125.663mm^2

Total resisting area=2827.433-
125.633=2701.769mm^2
Force at crank pin:
T=F×r
F= 36.084×0.06= 601.4N
Pressure applied P= F/A=601.4/2701.769
= 0.22 N/mm^2

V. RESULTS AND DISCUSSIONS

The machine fabricated as per the customer requirement for domestic use and small scale catering services functioned perfectly as desired with maximum production of 10 extrusion of rice balls into rice noodles per minute with a operating cost and labour cost of 5 Rs per minute.

VI. CONCLUSIONS

The operation of the machine is smoother just as the conventional machine but at much faster rate hence the feeding should be compensated with an automatic unit and the collecting mechanism synced the speed perfectly and with a higher power motor larger volume of extrusion is possible for every batch of feed for the serving the customer demand

REFERENCES

[1]. “String hopper making machine‖ US7160098B2