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Design & Fabrication of Electrically Operated Papad Making Machine

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Abstract*: Now a days in India, grain is one of the daily staples, consumed in the form of different flat breads such as Papad, Chapati and Roti. There are different varieties of grains have been used for the production of flat breads. In recent years, many researchers have tried to improve ingredient level, baking properties, nutritional value and extension of the shelf life of flat bread. They are usually produced from a simple recipe consisting of grains, salt and water in varying proportions, however, sometimes the manufactures also use optional ingredients like yeast fat, skim milk powder and certain additives like emulsifiers, hydrocolloids, enzymes and preservatives for quality improvement and shelf life enhancement. So to overcome this deign such type of machine that would help to quality improvement. To develop a machine having smaller in size and less bulky and cost effective especially for villagers. It is suitable for changing size of Papad with less effort. Designing such type of machine having optimum production and affordable for household business.

Keywords: Papad, Drier, Rolling Mechanism, Pressing, Air.

I. INTRODUCTION

Papad is a popular and tasty food item in the Indian diet since many centuries. Traditionally the activity was confined to household Papad making but in view of increasing demand and availability of machinery (mechanization) it has now been developed in cottage and small scale sector. Manufacturing of Papad is one of the traditional activities in the rural area in the Country. Its preparation method is cumbersome and unhygienic. The dough prepared by kneading the grains/daal mixture is cut into balls and hand-rolled using roller and plate. The major drawback of this manual process is the rolling capacity which can produce only about 30-40 Papad/ hour. Papad is either leavened or unleavened flat bread consumed throughout the Indian subcontinent and other parts of Middle East. It is usually prepared from whole grains and sometimes yeast and fat is also included in the formulation to improve the dough handling, mixing and textural properties. The product is prepared by mixing the grains with water and other ingredients to develop the dough, sheeted and dried for short time. They have creamish brown colour generally prepared in households, forming a cheap source of protein and energy. The grains is mixed with water, shortening and salt, sour dough or yeast, and is creamish brown to brown in colour.

II. CONSTRUCTION

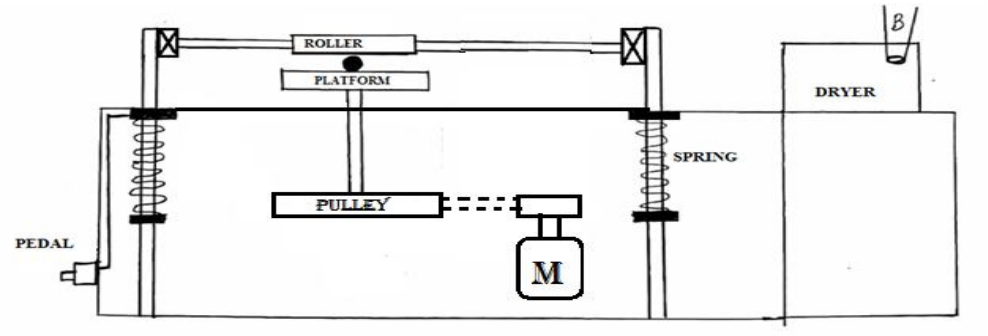

Fig.1: Conceptual Diagram Of Papad Making Machine

Figure shows a schematic sketch of machine along with its components and various drives. It consists of a motor for its initial drive with specification 0.5HP, with shaft speed of 1440rpm, further fixed to frame of the machine. Shaft of the motor is mounted with pulley having a groove to mount on belt. Belt is further connected to a pulley that gives 1st speed reduction. Bigger pulley is mounted on a shaft which is further connected to rotating platform where material for making papad is kept in spherical form. All

these assemblies including pulley, belt & motor are fixed to a frame having suitable dimensions. Machine is having two vertical post to mount the horizontal roller. Bottom ends of post are fixed to frame & top ends are provided with bearing to mount the shaft of roller. Roller itself is having bearing to have rotation within itself. Springs are mounted on vertical post which is fixed to post. Operator pedal is connected to top of the springs that exerts force applied by the worker. The machine further has a dryer located at the side of Papad platform that dries the Papad with the help of dry air.

III. WORKING

Initially a piece of circular plastic is taken on which the Papad material would be pressed. Plastic is provided with oiling to avoid sticking of Papad at high pressures. Papad dough is prepared separately with mixture of refined grains & water along with additives and is placed on the lubricated plastic. Another same piece of plastic is kept above it & covered properly. A light pressure is applied on the plastic above it to press it a little that avoids slipping of material during rolling. Switch is made ON and motor is started. Horizontal circular platform starts rotating with a designed velocity. Now this whole assembly of plastic & Papad dough is placed on the rotating platform & a slight pressure is applied on the pedal by the operator. The operator continues to apply force on the pedal, with the application horizontal roller moves downward pressing the material. With downward movement of horizontal roller, friction between roller & Papad exerts rotation in the roller & the roller starts rotating with some velocity. Roller forms a line contact with the Papad material exerting a force that flows along its circumference leading to flattening of Papad. Operator continues to apply force on the pedal until the required thickness of Papad is reached. Further operator removes force and plastic & flattened Papad is taken out, upper plastic is taken out & shifted to dryer compartment for drying. Here it is kept for about 1minute, until the making of next Papad, for drying of its moisture, this operation would reduce the drying time of Papad. First operation is completed & another material is performed with same procedural steps.

Fig 2: Cad Model Of Papad Makinng Machine

IV. CALCULATION

A. Design Of V-Belt

Rated Power, P_{out}=0.37kw, η_{vbelt}= 0.90, $P_R = P_{out} / \eta_{vbelt}$ =0.41 KW

1) Design power, $P_d = P_R \times k_l$ =0.451KW

2) D_1=38.1mm Peripheral velocity (from D.T. N_1=1440 rpm), Vp= ($\Pi D_1 N_1$)/1000=2.87 m/sec

3) Assume negligible slip: $V_{driven}=V_{driver}$ $D_1N_1=D_2N_2$, D_2=203.2 m

4) Angle of Lap (θ) $\theta_1 = \Pi-(D_2- D_1)/C$=2.45 rad ----------($C=D_1+D_2$) $\theta_2 = \Pi+(D_2- D_1)/C$ =3.82 rad, $\mu_1 = \mu_1$ =0.3 ---------->for C.I. & rubber belt

5) Belt tension ratio:- (F_1/F_2 =) =9.56 & (F_1/F_2) =33. Select lower value, (F_1/F_2) =9.5

6) Length of belt: $L= (\Pi/2) \times (D1+D_2) + (2\times C) + (D1-D_2)^2/4C$= 88.9m

B. Design Of Spring

Load of operator on pedal (As per ergonomic study), average human can exert 70N load comfortably.

Weight requirement of Papad rolling- 0.5-0.7kg

Papad size considered- 20cm dia. 1mm thickness, Pressure exerted= 222.92Pa Let C=5.5

Material- chromium vanadium steel SAE 6150

Sut = 1690 Mpa, Sys = 770 Mpa

τ_{max} = Sys/Fos = 385 Mpa

1) Diameter:

$\tau = (8FC/\pi d^2)*K_w$

$K_w = [(4c-1)/(4c-4)]+(0.615/c) = 1.27$

$d \approx 2mm$

Checking Shear Stress,

$\tau = (8FC/\pi d^2)*K_w$

$\tau = 245.09Mpa \leq \tau_{max} = 385$ Mpa.

Shear stress value is under safe zone with this index value. Spring is under safe zone.

2) Coil Dimension

$C = D_m/d = 11mm$

$D_o = D_m+d=11+2=13mm$

$D_i = D_m-d=11-2=9mm$

3) No. of Coils

(Deflection of 40mm by equating volumes)

$\delta=[8FD_m^3/Gd^4]*n=9$

Taking square and ground end $n'=n+2=11$

4) Free length= $n'd+\delta+0.15\delta = 68mm$

V. ADVANTAGES

A. Our design is having reduced size, weight & is convenient to keep in homes easily.

B. Machine has reduced cost that would be affordable to middle class families & home businesses.

C. Changing Papad dimensions in this machine is comparatively an easier task, just by application of pressure over a rotating material. It does not require any assembly changing and time consuming activities.

D. Only a single worker can work on this machine to carry out Papad rolling & handling activity

E. Energy consumption as compared to present machine is very low as it has 0.5HP motor as compared to 2HP motor.

VI. CONCLUSION

In this project we have concluded that as day by day there is more requirement of skilled labor because of faster rate of development in food processing area. Hence to reduce human effort and to reduce working time for Papad flattening operation we have developed simple Papad making machine for production of Papad which plays an important role in middle class people's business. Our machine makes Papad with the help of rolling & pressing mechanism and v-belt drive with pulley arrangement is used to transmit power.

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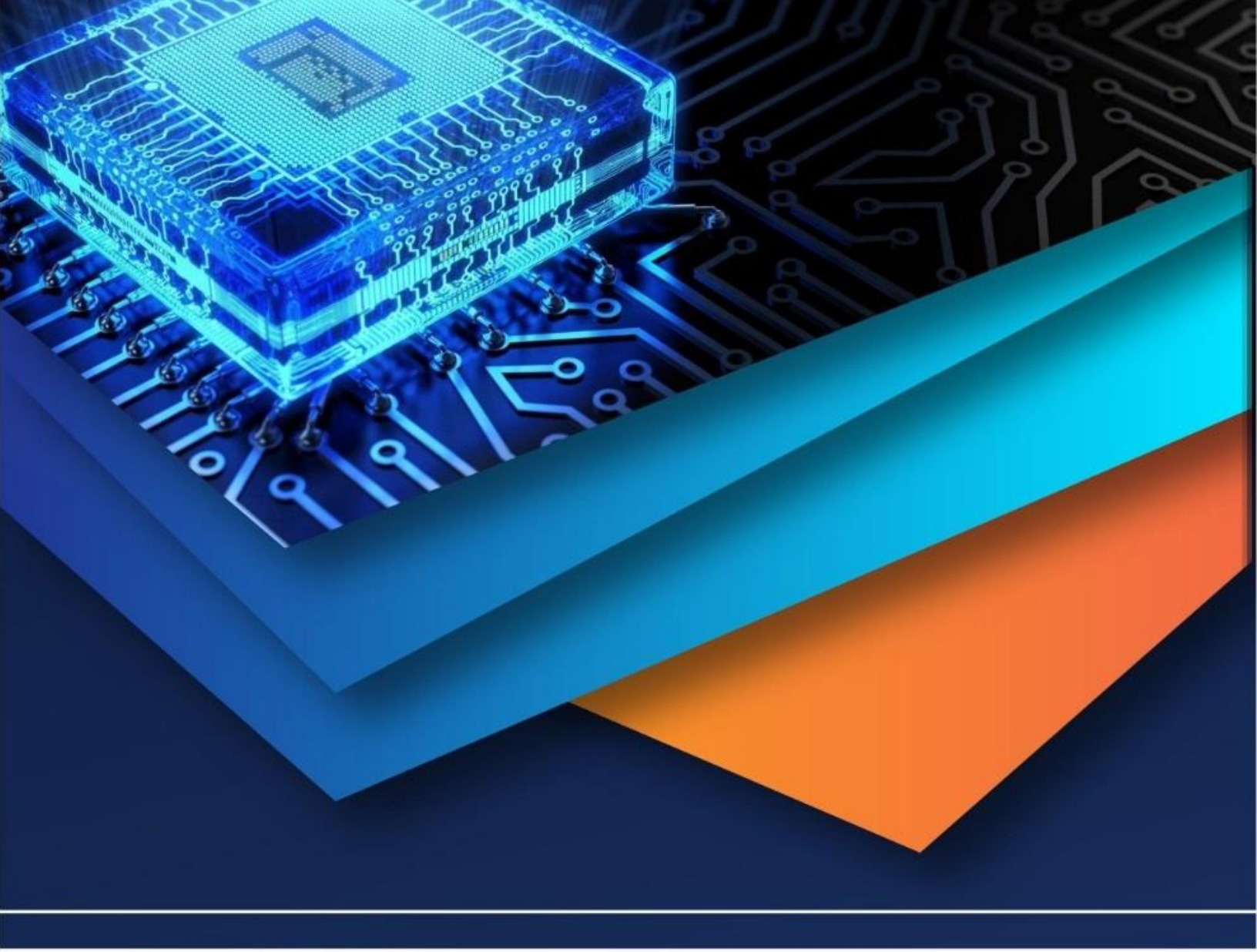

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