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Advanced Pneumatic Technology for Semi-Automated Kurdai Production

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Abstract:- The top choice dish in summer in Maharashtra is Kurdai which is made by wheat. The objective of this paper is to encourage the simple, speedy, and broad generation of kurdai. The paper started with a conceptualizing session, thought perception, extend needs determining, and point by point investigate including all of the competitive Kurdai machines within the advertise. The proposed Kurdai machine is little in estimate, lightweight, and effortlessly worked by one individual. Kurdai are expelled at the forming pass on employing a double-acting pneumatic barrel to pump a steady supply of plungers into the kick the bucket, giving the kurdai the right shape. Kurdai machine plan and advancement including the integration of all thoughts and testing of an AC-power compressor-operated pneumatic kurdai creating machine.

Keywords:- *Kurdai, Kurdai Machine, Pneumatically Operated, Lightweight design, Quick Production, Easy Operation.*

I. INTRODUCATION

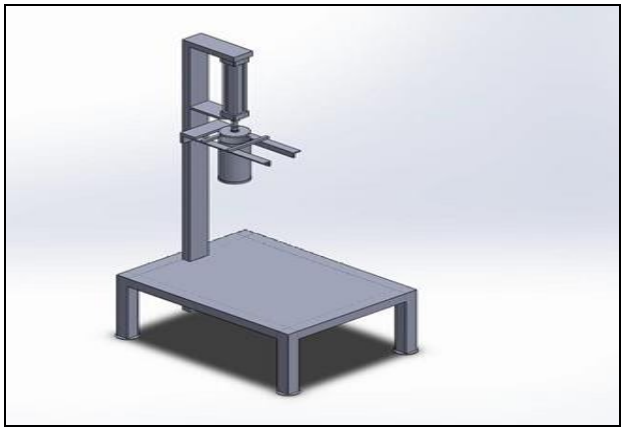

Fig 1: Figure of Machine

A classic Maharashtrian dish is kurdai. This cuisine, which falls beneath the papad sort, is one of a kind to the summer. This can be a unique summer dish since it is regularly made within the summer, sun-dried, and protected. When required, it is fricasseed. It contains a year's worth of capacity.

Even whereas making kurdai takes a parcel of exertion and time, the comes about are beneficial. We are subsequently making a semiautomated, pneumatically controlled Kurdai machine as a arrangement. Advertising an easy-to-use machine with ten unmistakable Jalees for Kurdai, Chakli, Murukku, Janthikulu, Chakli, and Idiyappam shapes. It is made of strong, long-lasting stainless steel, which gives it steadiness and quality.

Fig 2: Manual Traditional Kurdai Machine

Made numerous namkeens at domestic utilizing clean and nutritious ingredients. You'll wash it after each utilize. Without altering the machine, it is conceivable to form different assortments of murukku, kurdai, and chakli employing a single machine.

Rice flour, urad dal flour, salt, and water are combined to form the conventional Indian nibble known as kurdai. After that, the blend is steam-cooked to make little cakes, which are regularly served with sambar or chutney. A parcel of people would or maybe buy kurdai from stores than make them themselves since the method can be labor and time seriously. On the other hand, a semiautomatic kurdai machine can streamline and progress the method. We should conversation around the conception, creation, and appraisal of a semiautomatic kurdai machine in this consider article.

A. Design:

The semiautomatic kurdai machine is made up of a forming component, a steaming chamber, a transport belt, and a container for the flour blend. The container is filled with the flour blend, which is at that point nourished onto

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the transport belt. The blend is transported to the shaping mechanism by a transport belt, where it is shaped into minor cakes. After that, the cakes are put interior the steaming chamber and prepared by steam.

B. Development:

A combination of mechanical and electrical components was utilized in the development of the semiautomatic kurdai machine. Mellow steel was used within the creation of the container, transport belt, and shaping mechanism, which were all created with AutoCAD program. Fiber glass and stainless steel were combined within the plan of the steaming chamber. The machine's electrical parts comprise of a control board for machine operation, a warming component for the steaming chamber, and a motor for the transport belt.

C. Evaluation:

The adequacy and efficiency of the semiautomatic kurdai machine were surveyed in arrange to determine its rating. The machine's productivity was evaluated by timing how long it took to make a given amount of kurdai as contradicted to the labor-intensive, hand-made strategy. Comparing the machine-produced kurdai to those made by hand permitted for the assurance of the machine's adequacy.

The evaluation's discoveries illustrated that the semiautomatic kurdai machine beated the ordinary hand-made kurdai strategy in terms of proficiency. With less effort from the administrator, the machine was able to make more kurdai in a shorter sum of time. There was little discernible difference within the taste or surface between the kurdai made by machine and those made by hand.

D. Components

Components used for Machine are as follows:

- *Air Compressor*
- *FRL unit*
- *Double Acting Cylinder*
- *5/3 Direction Control Valve*
- *Flow Control Valve with Check Valve*
- *Hoses and Connectors*

- *Air Compressor*

Fig 3: Air Compressor

In spite of the fact that they are a generally modern advancement in the history of the machine age, discuss compressors have played a critical part within the operations of factories and workshops around the world within the present day world of pneumatics.

Numerous devices utilized to be fueled by perplexing frameworks with belts, wheels, and other colossal components some time recently discuss compressors. Expansive, costly, and overwhelming, this hardware was usually out of reach for numerous little businesses. Air compressors are a common locate on gigantic shop floors, auto workshops, and indeed your neighbour's garage these days. They come in a variety of sizes and plans. We'll go over the elemental operation of discuss compressors as well as the various ways that they oversee discuss uprooting in this article.

By applying weight to encompassing discuss, discuss compressors create potential vitality that can be stored in a tank for afterward utilize. When compressed discuss is deliberately discharged, weight builds up, much like in an open swell, changing potential vitality into valuable kinetic energy. A while later, diverse pneumatic tools can be fueled by this vitality exchange.

Combustion motors and industrial air compressors work in comparative ways. A pump barrel, cylinder, and crankshaft are regularly required for discuss compressor working in arrange to exchange vitality for a extend of capacities. These principal parts can be utilized to control rebellious like drills, nail guns, processors, sanders, and shower weapons, or they can offer assistance supply discuss for filling up things like tires or inflatable pool toys.

Various multipurpose air-powered hardware and machines, extending from affect torques to discuss conditioners, are responsible for the comfort, security, mechanization, and viability of day by day living. Compared to customary centralized control sources, the compressors themselves are lighter and more versatile. In comparison to other old-fashioned adapt, they are also more portable, durable, and low upkeep.

- *Specification*

✓ Capacity: 150 PSI i.e., 10 Bar.

➢ *FRL Unit*


Fig 4: FRL Unit

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A channel, a controller, and a lubricant make up a FRL unit. To ensure the conveyance of clean discuss at set weights, they are regularly utilized in compressed discuss applications.

Furthermore, grease is discretionary in the event that users want to affirm that the system's pneumatic components are working to their greatest potential. The operation of FRL units in Pneumatic frameworks.

Pneumatic frameworks as often as possible get compressed discuss that is unlubricated, contaminated, or over-pressurized. Channel controller lubricator units are valuable in this circumstance. FRL frameworks make beyond any doubt that any compressed discuss utilized to control apparatus is free of contaminants, which makes a difference avoid harm to downstream hardware.

Pneumatic frameworks require the three essential parts of FRL units to fulfil their particular capacities:

To begin with and preeminent, the channel frees pneumatic frameworks of dangerous impurities like water and tidy. This starts the process of improving the virtue of compressed discuss.

In order to anticipate downstream components from working above their maximum operating weights, the controller moreover adjusts and controls compressed discuss weight.

Lastly, to offer assistance with any contact inside other pneumatic framework gear, the lubricator sprays a controlled mist of oil into the compressed discuss supply.

Pneumatic frameworks that have FRL units introduced have distant more dependable forms, with essentially less control squandered and longer component life expectancies as a result of the made strides lifecycle.

➢ *Double Acting Pneumatic Cylinder*

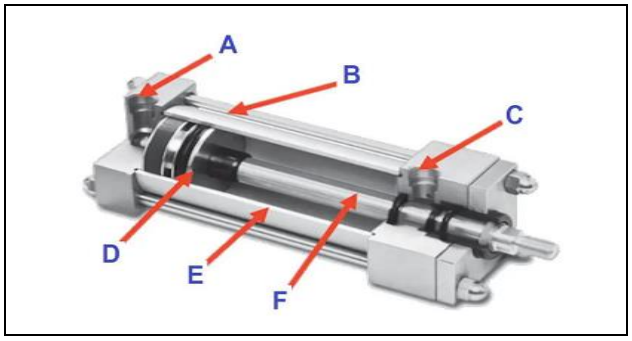

Fig 5: Double Acting Pneumatic Cylinder

The final part of a pneumatic or compressed discuss control mechanical gadget are pneumatic cylinders, regularly known as discuss barrels. Compressed air power can be changed over into mechanical vitality utilizing discuss or pneumatic barrels.

Direct or pivoting movement is created by the mechanical vitality. In a pneumatic framework, the actuator is the pneumatic discuss barrel. In this way, the term "pneumatic straight actuator" refers to it.

A mechanical gadget that transforms compressed discuss vitality into a straight movement that reciprocates is called a pneumatic barrel. Whereas a single-acting cylinder employs compressed discuss for one-way movement and a return spring for the other, a double-acting cylinder uses compressed discuss to impel a cylinder in and out. They come with a ton of connections, such as sensors to track the piston's position and different mounting adornments to connect the barrel or add parts to the piston's conclusion. Pneumatic barrels are utilized in numerous diverse divisions that require direct movement since they are an reasonable and easy-to-use alternative. Another title for them is air barrels. Making the right choice in pneumatic barrel determination makes a difference ensure an application's long-term execution and enhance the suitable in general machine execution.

- *Specification*

✓ Pressure: 0.5 to 10 bar
✓ Stroke Length: 200 mm
✓ Diameter: 40 mm
✓ Type: Double Acting

➢ *5/3 Direction Control Valve*


Fig 6: 5/3 Direction Control Valve

Three states and five ports make up a 5/3-way valve. Two solenoids, each able of controlling a valve state, are display. The valve returns to the central condition within the occasion that no solenoid is actuated. The valve is hence mono-stable. The central state may serve a variety of purposes, such as blocking all ports. A double acting barrel that should be bolted at intervals along the stroke is an illustration of such application.

The valve permits liquid to pass through the different ports when it is invigorated since it flips between two positions. A 5/3-way solenoid valve, on the other hand, has three settings and five ports. It has three positions, one for ordinary closure and the other for typical opening of deplete.

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➢ *Flow Control Valve with Check Valve*

Fig 7: Flow Control Valve with Check Valve

Pneumatic frameworks utilize stream control valves to alter the compressed discuss stream rate. The pneumatic cylinder's speed can be straightforwardly balanced by altering the stream rate. Besides, a well-designed throttling valve makes a difference to play down wear by bringing down the dynamic stack. Furthermore, the control valves encourage a development that's more reliable and steadier. The last mentioned relates to the fact that speed can change in the event that speed isn't controlled. Thus, there may be a adhere or slip impact, which may cause the activity to waver.

A stream control valve (FCV) controls the stream of fluids, gasses, and discuss. Past that, the Proportion-Air FCV stream control valve controls a needle valve's position off the situate utilizing pneumatic constrain.

➢ *Hose Pipe and Connectors*

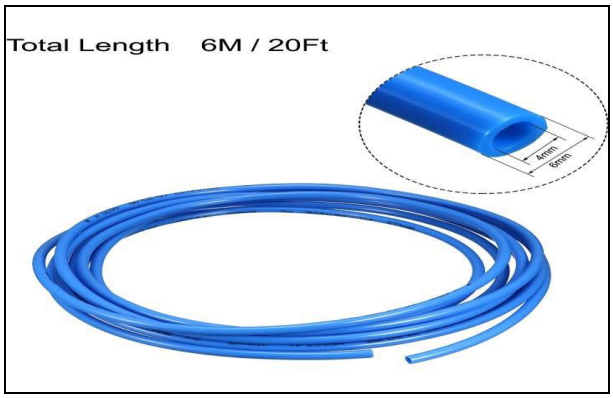

Fig 8: Hose Pipe and Connectors

- *Specifications:*

✓ Outer Diameter: 6 mm
✓ Inner Diameter: 4 mm
✓ Length: 6 m

A adaptable empty tube utilized to transport liquids from one put to another is called a hose. In expansion, hoses can then again be alluded to as channels, or more broadly, tubing (as restricted to the more unbending term "pipe," which ordinarily signifies a adaptable tube). A hose ordinarily includes a round and hollow shape with a circular cross area.

The plan of hoses is decided by both execution and application. Estimate, weight, length, coil or straight hose, pressure rating, and chemical compatibility are common contemplations.

Depending on the climate and required weight rating, applications mostly use nylon, polyurethane, polyethylene, PVC, or manufactured or characteristic rubbers. Of late, specific sorts of polyethylene, particularly low-density polyethylene (LDPE) have been utilized to form hoses. PTFE (Teflon), stainless steel, and different metals are cases of other hose materials.

The history of digging elastic hoses is broad and incorporates exceptional adaptability and quality. a flexible digging hose that's regularly utilized in dredgers to move rock or residue. Its amplified benefit life is ensured by its resistance to wear and scraped area. Adaptable digging hose comes in a assortment of shapes, counting as ceramic, armored, release, suction, and coasting elastic hoses.

II. DESIGN AND FABRICATION

A. Seamless Cylinder

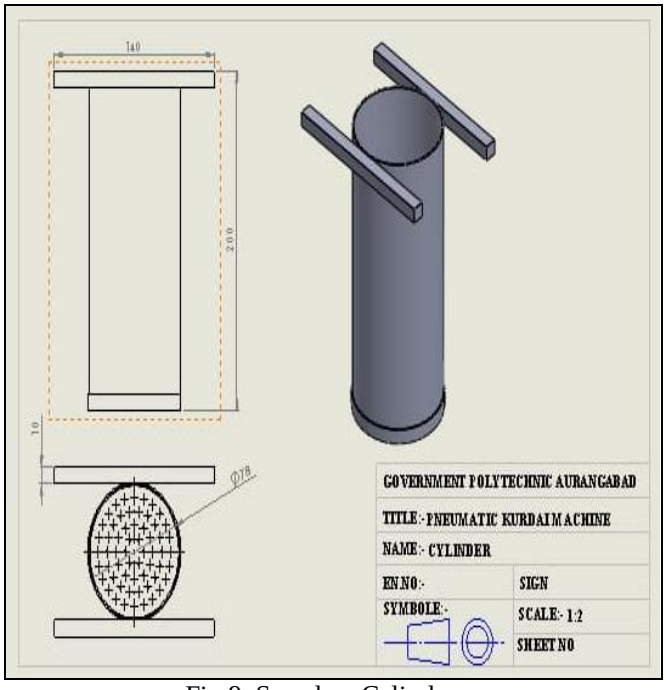

Fig 9: Seamless Cylinder

- Diameter: 80 mm
- Length: 200 mm
- Thickness: 4 mm
- Material: Seamless steel.

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B. Plunger

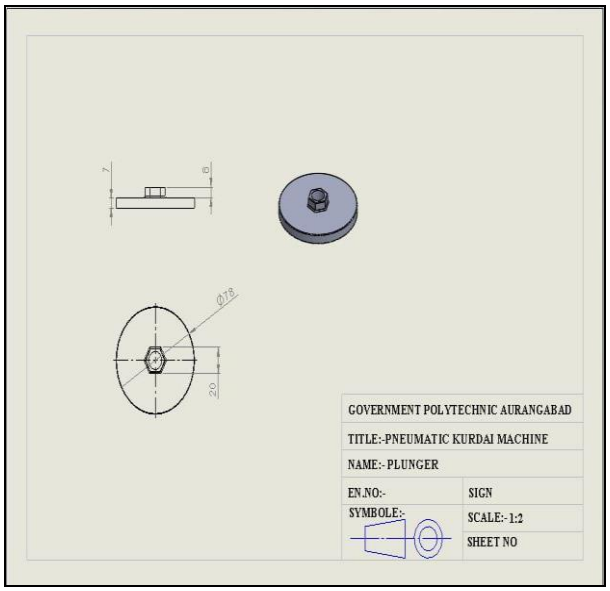

Fig 10: Plunger

- Diameter: 78 mm
- Thickness: 3 to 4 mm

C. Body

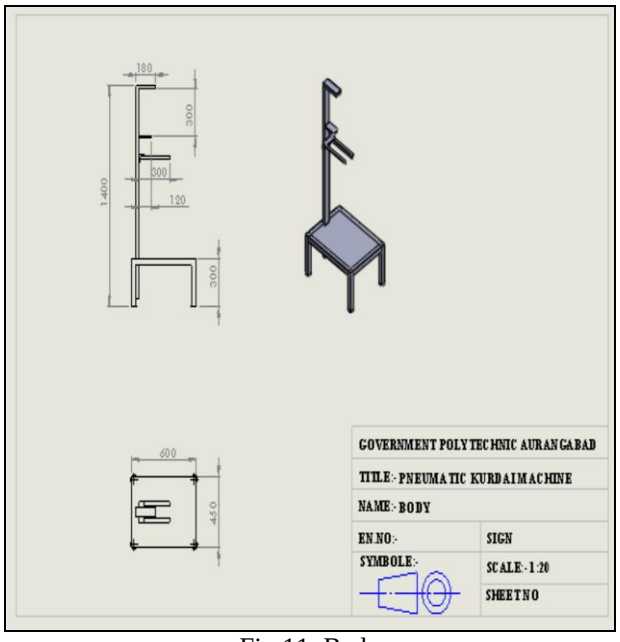

Fig 11: Body

- Material used: Iron
- Base plate size: 1.5×2 feet
- Base plate width: 1 inch
- Vertical column height: 4.5 feet
- Column size: 1 × 3 inch

D. Pneumatic Double Acting Cylinder

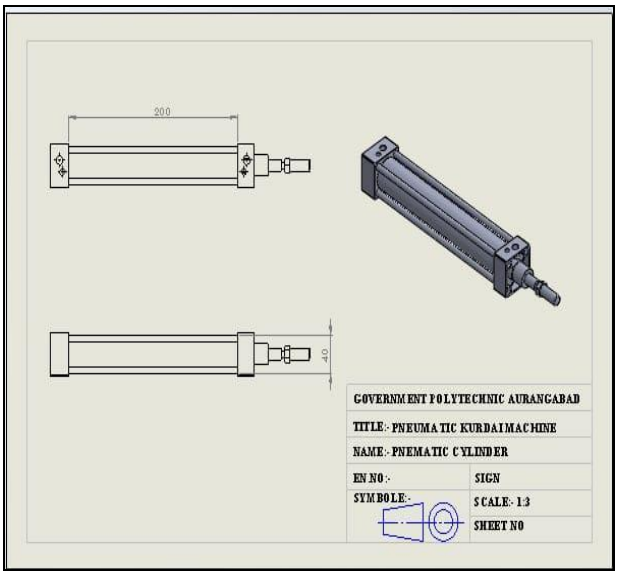

Fig 12: Double Acting Pneumatic Cylinder

- Pressure: 0.5 to 10 bar
- Stroke Length: 200 mm
- Diameter :40 mm
- Type: Double Acting

E. 3D Model

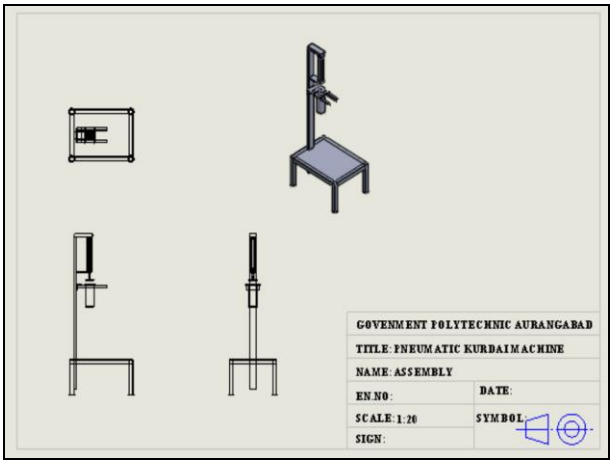

Fig 13: 3D Model

III. WORKING AND CONSTRUCTION

A. Working of Machine

As the title recommend semi-automatic which means a few operations are worked by physically and a few worked by consequently. The programmed portion of working is the extraction of kurdai from the given pass on set, by utilizing pneumatic weight and the manual portion is moving plate. underneath the kurdai extricated the from die in given shape or as per necessity.

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The machine employments tall pressurized pneumatic (air) for the operation. The tall pressurized pneumatic discuss is gotten from the compressor. Here the compressor with up to 10 bar weight and capacity tank required. The tall pressurized discuss is firstly stored the supply and after that provided to -FRL unit. i.e., Channel - Controller- lubricator. This tall pressurized discuss sifted. At that point Set as prerequisite, for operation we set discuss at required weight (roughly 3 bar 3 to 3.5 bar). This discuss is provided to the Heading Control Valve (DCV), as we require 3 positions for operation. We use 5/3 lever worked Course Control valve.

The associations from the DCV are associated to the Barrel Stream Control valve (FCV). As in commonsense working without Stream control valve the withdrawal stroke does not works appropriately, so Stream Control is fundamental for the smooth and Frictionless operation.

The plunger is connected to the barrel bar with nut-bolt course of action concentricity. is kept up between plunger and the fabric holding consistent steel barrel for smooth working. As we require 3 developments of plunger that are. Expansion withdrawal and unbiased. For that 5/3 DCV is utilized.

When we work the lever in a specific heading, expansion stroke is happened. In expansion -stroke plunger moves from upper side to lower side. As this development makes weight on the fabric filled inside stainless steel Barrel, the fabric begins compressing and moves towards foot. At foot pass on is set, the fabric moves in given pass on shape towards the ground and physically a plate is spun or moved as per required shape of item.

When we got to halt the stream of fabric, we set the lever of DCV to impartial position. And when the fabric interior Barrel works the DCV to inverse course i.e., Inverse to extraction stroke direction. And the plunger comes to its unique position. That's how the semi-automatic kurdai making machine works.

B. Construction of Machine

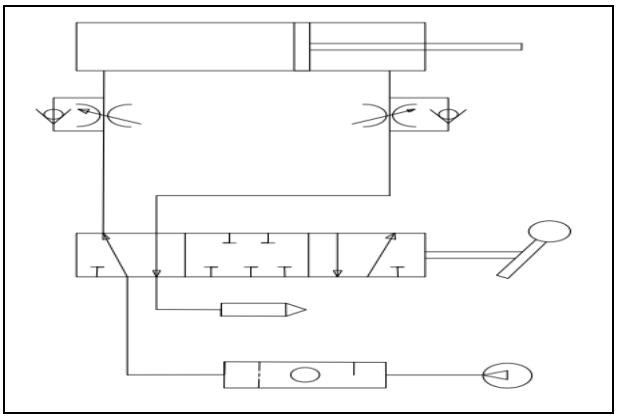

Fig 14: Meter-out Circuit

The stream control valve within the meter-out circuit is joined within the auxiliary line, right after the stack. The taking after weight readings are gotten utilizing diverse weight gages.

Subsequently, it ought to moreover be noted that stream control in a particular circuit as it were works in a forward heading, meaning that amid the return stroke, the check valve bypasses the stream of the pump to the cylinder bar conclusion of the cylinder.

The stack in a meter out circuit is counteracted since it is continually beneath weight from both sides. There's no wildly sudden snapping movement, indeed when the weight reverses course.

Meter-out circuits have been demonstrated to work well for a few forms, counting boring, reaming, and penetrating.
The ideal course of activity in these exercises, when the drills and plants going through the workpiece regularly tend to drive the whole apparatus unit ahead, is to utilize a meter-out circuit.

IV. SAMPLE CALCULATIONS

A. Force Required for 2.5 bar Pressure

- P = $2.5\times10^2\ N/m^2$
- $A = \pi 4\ d^2$
- A = $\pi 4(40)^2$
- A = 1256.63 m^2
- F = P×A
- F = $(2.5\times10^5) \times (1256.63)$
- F =31.42×10^4 kN

B. Force Required for 3 bar Pressure

- P = $3\times10^5 N/m^2$
- F = P×A
- F = $(3\times10^5) \times 1256.63$
- F = $37.69\times10^4\ kN$

C. Force Required for 3.5 bar Pressure

- P = $3.5\times10^5 N/m^2$
- F = P×A
- F = $(3.5\times10^5) \times 1256.63$
- F = $43.98\times 10^4 kN$

D. Force Required for 4 bar Pressure

- P = 4×10^5N/m^2
- F = P× A
- F = $(4\times 10^5) \times 1256.63$
- F = $50.27\times 10^4 kN$

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V. RESULT AND DISCUSSION

A. Stages for Operating Machine

➢ *Stage 1:*

Primarily we made wet paste for kurdai by soaking wheat in water for 3 to 4 days and after that we heated at required temperature.

➢ *Stage 2:*

We filled hot wet paste of wheat in seamless cylinder as shown below.

Fig 15: Stage 2

➢ *Stage 3:*

After that we arranged this seamless cylinder in frame of machines cylinder to proper alignment with piston rod of pneumatic cylinder and plunger.

Fig 16: Stage 3

➢ *Stage 4:*

We connected pneumatic meter-out circuit and air pressure supply is measured. We used 5/3 DCV. After that We obtained our desired product with desired shape i.e. kurdai at 3.5 bar pressure.

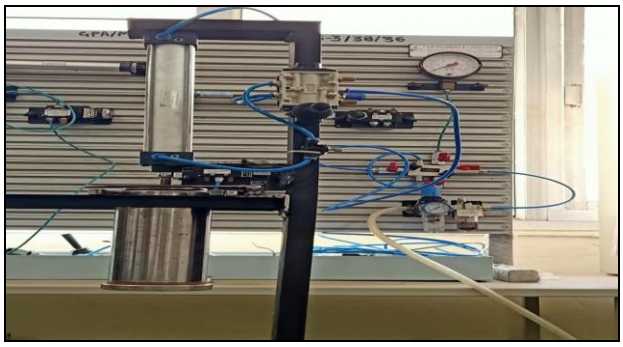

Fig 17: Stage 4

➢ *Stage 5:*

We obtained our product as shown in below image and photos.

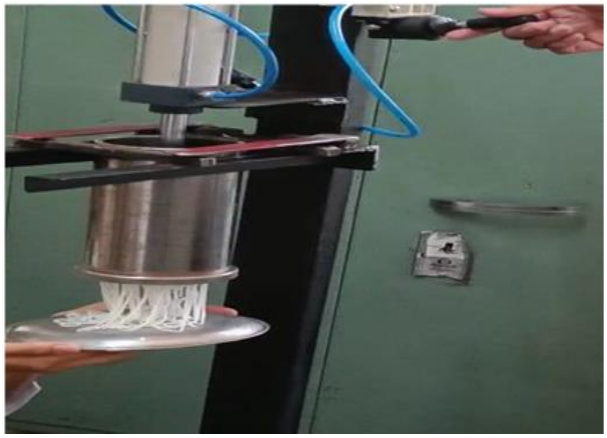

Fig 18: Stage 5

Table 1: Result Table

Sr. No.	Pressure (bar)	Time required for 1 kurdai (sec.)	Time required for complete stroke of pneumatic cylinder (Sec)	Production per hour
1.	2.5	7	84	514
2.	3	5	66	654
3.	3.5	4	48	900
4.	4	3	36	1200

VI. CONCLUSION

The semiautomatic kurdai machine is a promising innovation that can simplify the process of making kurdai and make it more efficient.

The machine has the potential to increase the production capacity of kurdai manufacturers and reduce the labour required for making them.

Further research and development are required to optimize the design and improve the performance of the machine.

Overall, the semiautomatic kurdai machine is a valuable contribution to the food processing industry and has the potential to revolutionize the way traditional Indian snacks are made.

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