DETAILED PROPOSAL

ON

GASOLINE- POWERED MACHINE FOR THE PRODUCTION OF KOKORO SNACK

BY

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BACKGROUND INFORMATION

The food processing industries in Nigeria are on the increase with the aim of meeting the ever- increasing market demand for daily needs of the teeming population and reduce over dependence on imported food so that our local industry can thrive, produce what we need, and people can consume what we produce. (Ajila, et al..2010)

Over the years, various government policy on industrialization and localization of industry changes with change in government thus resulting in policy somersault or reversal; this has been the bane of the small & medium scale enterprise in its bid for industry expansion through the fabrication of machines and equipment to run our indigenous industry.

PROBLEM STATEMENT

The problem statement is on the design and fabrication of a gasoline powered machine for the production of kokoro snacks to enhance hygienic production of additional snacks for human consumption, promote indigenous technology and solve the problem of food insecurity in Nigeria.

OBJECTIVES

The objectives are:

LITERATURE REVIEW

According to research, snacks can be used to increase the nutritional status of consumer by incorporating nutrient such as carbohydrate, fiber and protein from plant sources which have health benefits. Zazueta et al (2001). Kokoro is a fried snack popular in Ogun state, it is a sweet, cookie-like product made from maize, salt, groundnut oil and onion.

More than 80% of the raw materials used for the production of animals, requires grinding according to (Đuragić et al., 2002). Grinding is done, above all, for all kinds of cereals, and by-products from agriculture and feed industry such as meal, cake and mineral nutrients according to (Đuragić et al., 2002).

The structure of grinded product, whether the focus is on the individual components or finished mixtures, must meet the physiological requirements of the animals according to (Đorđević and Dinić, 2011). The finer the particles are, the greater is their specific surface.

In recent times, attempts have been made to design and fabricate machine that would converting semi- finished product (blended maize) commonly used for kokoro snacks or raw materials into finished products. The art of converting raw material into finished goods with application of different types of tools, equipments, machine tools, manufacturing set ups and manufacturing processes, is known as production. Generally there are three basic types of production system namely: job production, batch production and mass production and if this novel idea is adopted, it could be mass produced.

Snacks are described as foods usually taken to produce light sustenance in a quick and convenient way and it can also be substituted for meal when taken in large quantity.

Reasons for taking snack.

1. It is taken when the main meal is not yet available.

2. It is taken when you are going on journey and you do not want to eat main food at home.

3. It serves as a souvenir when coming back from a journey.

There are so many snacks in Nigeria such as meat pie, egg roll, doughnut, kokoro etc.

Kokoro is a processed fried product from maize that is been produced locally mostly by the Southwest of Nigeria, and it is produced predominantly in large quantity in Ogun State by the Imasayi and Iboro people of the state. It is being consumed throughout Nigeria and some other African country as snacks.

Kokoro is a snack that is produced from a processed corn. The production of Kokoro involves several critical processes such as grinding, mixing, rolling/extrusion and frying. These processes require a machine which comprises essentially of a gasoline engine, transmission shaft, hopper, mills, spiral conveyor and stands. These machines will reduce or eliminate the rigors involve in producing Kokoro snack manually. Another important process in Kokoro production is frying which also increases its shelf life and makes it suitable for storage over a short period of time. Deep fat frying is an established process of food preparation which involves simultaneous heat and mass transfer process. In this process, moisture leave the Kokoro pasta in the form of vapor bubbles and oil is absorbed simultaneously.

There are several ways and method of producing Kokoro of which in this project we shall focus on the method used by the Imasayi and Iboro people of Ogun State, Nigeria,

Several processes are involved in Kokoro snacks making which requires different machines for grinding, mixing, extrusion, frying and packaging. The focus is on the mixing and extrusion aspect of these processes, though extrusion/rolling is the most tedious part of the Kokoro production which is why we shall be focusing our research work on this aspect and due to financial constraint, we shall be limited to this aspect. There is no machine in a single compartment for producing Kokoro in existence except by arranging these machines in a production line of which financial constraint made us to be limited to the most tedious part of these processes (Mixing and Extrusion).

METHODOLOGY

The materials and methods employed for the fabrication of a gasoline powered kokoro pasta extruding machine that can accommodate multiple extruding shapes (round, square,

pellet) and it is an innovative design that will eliminate the traditional hand- rolling/ forming method of kokoro concentrate/ formula into solid cylindrical pasta form. A machine for mixing and forming blended maize and other ingredient and extrusion of maize into pasta for indigenous snack known as kokoro production was fabricated. Mild steel, angle iron, gear box, belt, stainless steel plate, stirrer blade, sheet metal, shaft, bearing, pulley, Gasoline engine, dies, bolt and nut, generator were purchased materials used for fabrication of the Kokoro pasta extruding machine.

The machine is powered by a gasoline engine with 1.5h.p rating. Power is transmitted via pulley and belt assembly to the fabricated machine component. The output speed from the driver pulley is regulated using a reducing gear system; this reducing gear helps in bringing down the torque [power from the gasoline engine to the required speed of the driven pulley attached to the machine mixing and extruding component.

In its working, the ingredients are mixed with the help of a stirrer and then pushed through a die of 10mm cross-section, its shape changes to reflect the die's shape. Products of extrusion are generally called "extrudates".

The stirrers are made of stainless steel to avoid contamination with the food product. The stirrer blades were welded to the shaft supported with bearings at both ends for smooth rotation and gripping, the shaft is rotated with the aid of a gasoline engine connected with belt to the pulley on the shaft and the speed is reduced using a gear box.

In the extrusion process, a ram is connected to the shaft for reciprocating movement which forces the kokoro billet through several dies to form its pasta shape. The shaft is connected to bearings at both end and connected to the gear box for rotation.

The developed machine is a novel because it will help to provide solution to the monotonous and tedious human ergonomic efforts of seating in same position roll-forming the kokoro formula into solid cylindrical shape, improve the hygienic taste of the end product as human sweat that used to form part of the taste are eliminated. The

machine requires no electricity hence it can be deployed or used in areas with epileptic power supply or without on- grid power source.

d) Brief Description of the machine

Basic engineering materials were selected and purchased; working drawing specifications were used in the dimensions of manufactured parts, assembling of all parts together was done and located in suitable frame, which carry the different units without baulking the performance of the engine and the extruder. Performance tests were done to judge the machine transmission mechanisms are as shown in the subsection designs below.

Kokoro pasta extruding machine is an embodiment of several major component parts like mild steel body cover, angle iron, gear box, belt, stainless steel plate, stirrer blade, sheet metal, shaft, bearing, pulley, Petrol engine, dies, bolt and nut, generator were purchased materials used for the fabrication of the Kokoro Pasta processing machine. The design specification of various components that makes the entire assemblage comprises of a gasoline engine that provide the required power for the kokoro pasta extruding machine that was fabricated in the workshop section of the Department of Mechanical Engineering of The Federal Polytechnic Ilaro. This prime mover of 1.5 h.p, 1800 rpm, two-stroke petrol engine was selected and is capable of providing the required power. The pictorial view, isometric view, 3D assembly, orthographic view, front view, side view and plan of the kokoro pasta extruding machine are shown in Figures 1, 2,3,4,5 and 6 respectively.

Designing the stirrer blade**, t**he mixing unit consists of several blades of the same dimension. These blades are made of stainless steel due to their ability to prevent contamination of the food product and resistance to corrosion. These blades are cut into appropriate dimension and joined to the shaft for thorough mixing of the pellet with other ingredients. The machine is powered by a petrol engine of 1.5h.p. The petrol engine is used to generate the torque needed for shaft rotation.

The power reduction system is a gearbox containing gear train, or a mechanical unit or component consisting of a series of integrated gears within the housing. In the most basic sense, a gearbox functions like any system of gears, it alters torque and speed between a driving device like a motor and a load. Gearbox was purchased from the local market. Gearbox encompassed transmission unit shafts on the two ends and it has a reduction of 8:1. Gearbox was purchased from the local market. Gearbox encompassed transmission unit shafts on the two ends and it has a reduction of 8:1. A square rod from the two strokes engine enters a square hole housed by flexible fibre and piping. The rod then enters a bearing section inside the pipe where 8mm rod from the bearing section continues the transmission chain to a pinion gear that has a spin on it. The spin on the pinion gear (25mm diameter) is keyed into a flange teeth assembly on the transmission chain. As the engine is started, power is then transmitted to the shafts of the traction wheels in the ratio of 8:1 which in turn cut weeds at either section. 30 rpm rotation speed or more is provided for the ground wheel from the two strokes engine backed by the operator. From the engine to the throttle section, the dimension is 828mm. Throttle assists in varying the speed of rotation of the cutting wheel.

i. Shaft and blades

The length of rotor shafts (20 mm in diameter) was 2015mm in each case so that it could cover the entire inter row spacing surface. The blades of the rotor were made of mild steel flat of 25mm width and 5 mm thickness. The radius of the rotor blades was kept as 26.73mm. Twelve blades of cutting width 150 mm were fabricated and six blades were provided on each flange. Each rotor shaft was provided with one pair of flange, providing total width of cutting of 300mm for both sections. The rotor blades were fitted on mild steel flange of 150 mm diameter and 10 mm thickness. See figures 3 and 4 for details.

= 1.613kw

≈ 1.61 kw

Where, P is power requirement in HP, SR is soil resistance (0.5 kgf/cm^2), d = depth of cut (4 cm), w is effective width of cut (43 cm), v is speed of operation (1.5 m/s) and η is transmission efficiency (80%). Hence, power requirement is estimated. From the above calculation, the estimated power of the two strokes petrol engine is 1.61kw was used as the prime mover.

(e) **Detailed Description of the Drawings**

The AutoCAD drawing showing the technical details of the machine is presented in figures 2 to 5. From an operator's safety point of view, all power transmission mechanisms or systems were covered to prevent clogging of driving and driven parts which could lead to eventual machine seizure. Also, the rubber seal between the cover and housing of the gear box assembly was incorporated to avoid dust accumulation. Provision of check nuts on all the transmission shafts was also provided and fitted tightly.

Component parts of the Kokoro Pasta Extruding Machine.

Component parts of the machine designed and fabricated for cylindrical or tube- like control of the pasta formula are as listed below and are as discussed in details in the next subsection.

The parts are:

i. **Stainless Steel Blade** – The mixing unit consists of several blades of the same dimension. These blades are made of stainless steel due to their ability to prevent contamination of the food product and resistance to corrosion. These blades are cut into appropriate dimension and joined to the shaft for thorough mixing of the blended maize with other additives or ingredients. It is for cutting or slicing the pasta.

ii. **Gear box** – A gearbox is a mechanical unit or a contained gear train or component consisting of a series of integrated gears within the housing. In the most basic sense, a

gearbox functions like any system of gears, it alters torque and speed between a driving device like a motor and a load. It is for prime mover speed reduction.

iii. **Shaft housing** – This is a compartment that houses the pinion gear assembly and it serves as a guard.

iv. **Handles** – These are collapsible hollow pipes bolted to the assembly frame for holding and pushing the machine from one location to another.

v. **Throttle Trigger** – This is a lever for raising the speed of rotor shaft connected to reduction gear assembly

vi. **Exhaust pipe** – This is the outlet pipe from the gasoline engine through which the exhaust gases are discharged.

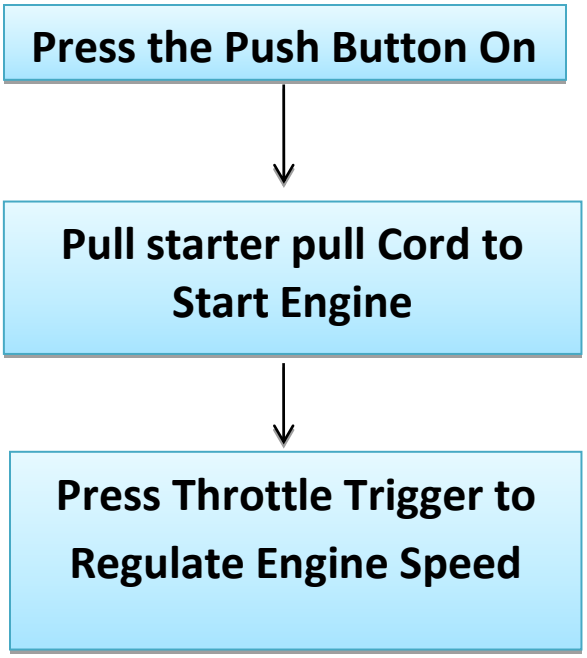
vii. **Connection cable** – This is used for the supply of current to the throttle section

viii. **Starter pull cord** – This is a recoil mechanism used for starting the two strokes engine

ix. **Fuel tank** - This stores petrol fuel that powers the prime mover

x. **Strap frame** – This is used for backing the two strokes engine

FLOW CHAT FOR THE OPERATION OF THE KOKORO PASTA EXTRUDER



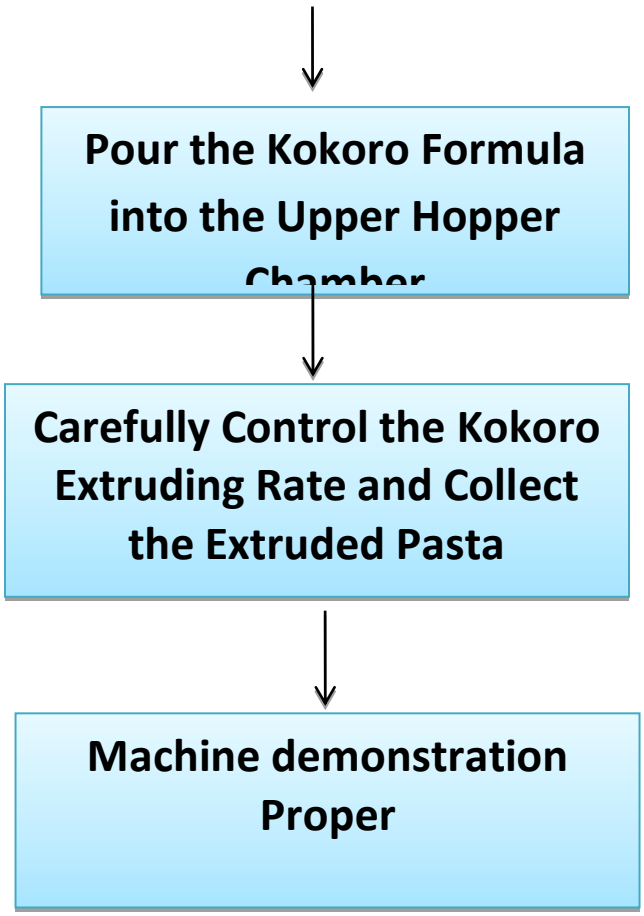


Chart 1: Operation Manual for the Kokoro Pasta Extruder

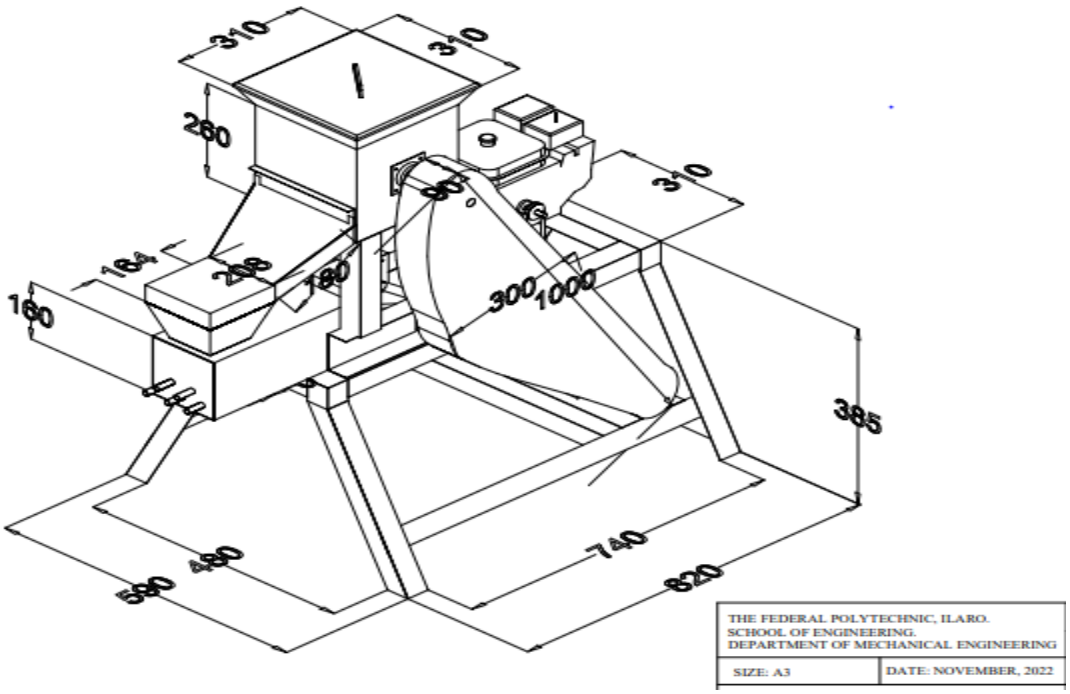


Fig. 2: Isometric View of Kokoro Pasta Extruding Machine

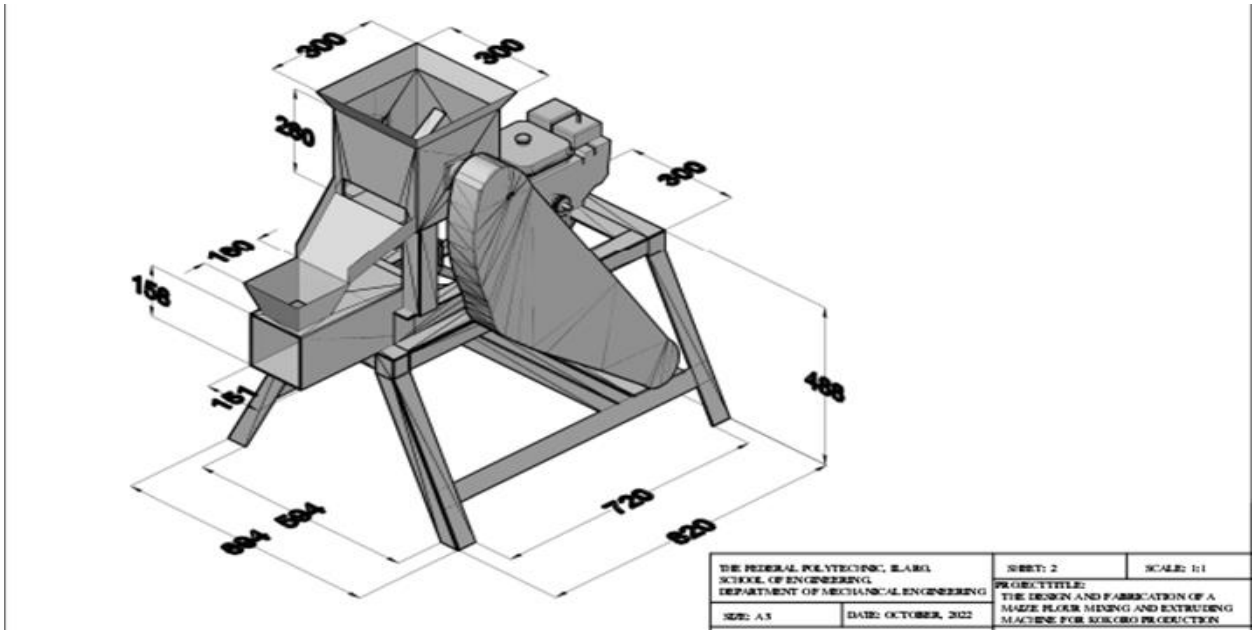


Fig. 3: 3-D Assembly Drawing of Kokoro Pasta Extruding Machine

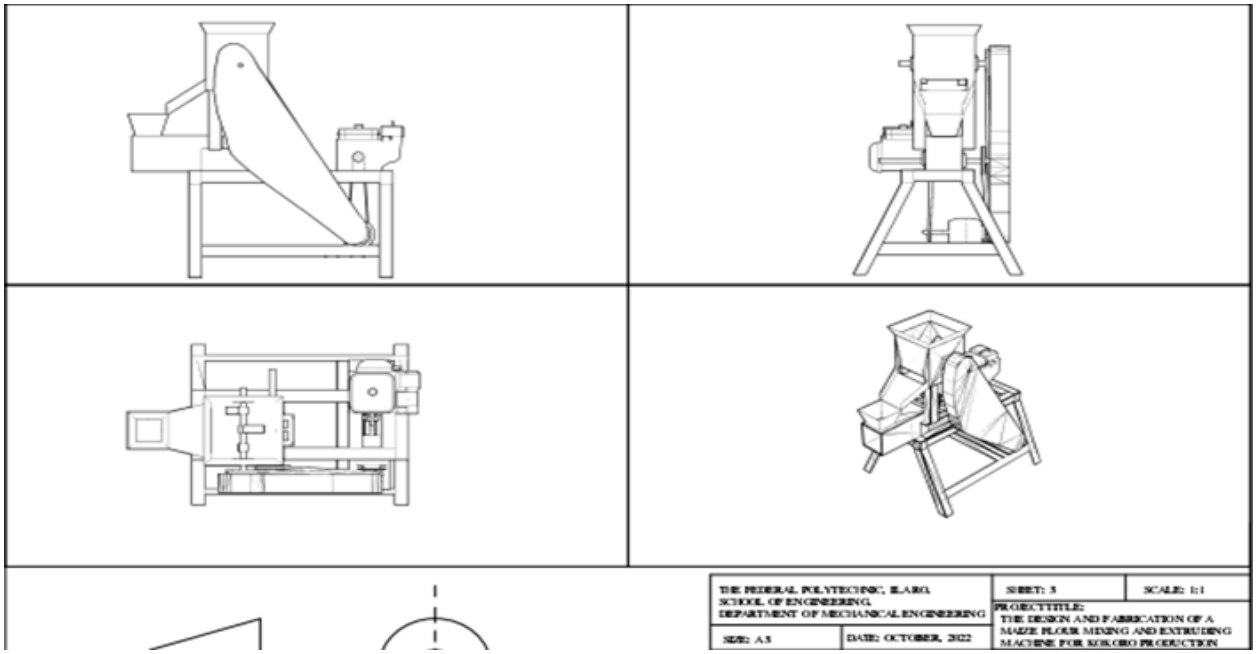


Fig. 4: Orthographic Drawing of Kokoro Pasta Extruding Machine

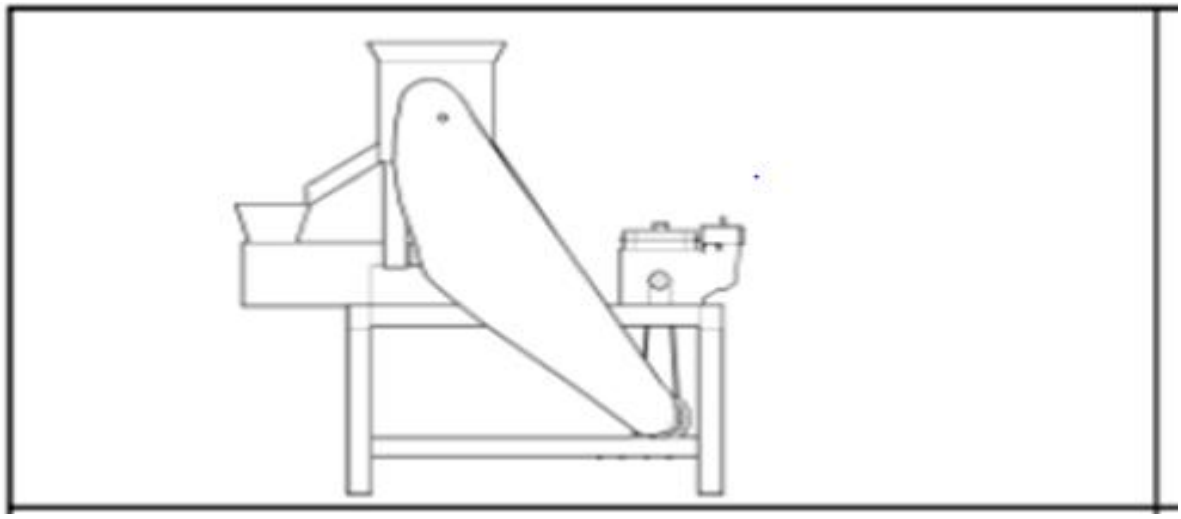


Fig. 5: The Side View of Kokoro Pasta Extruder

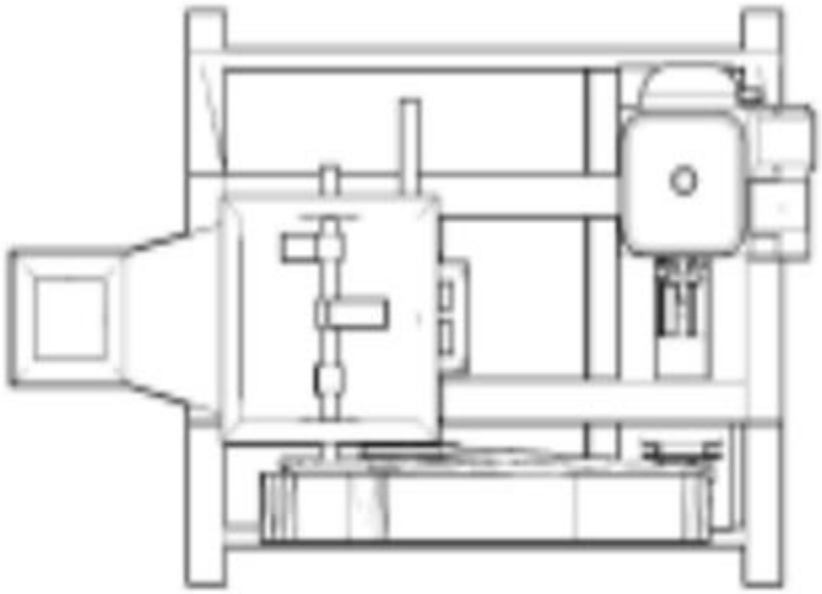


Fig. 6: The Plan View drawing of Kokoro Pasta Extruder