

AUTO PELLET MAKER

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Abstract

This project work discusses the design and construction of an Auto Pellet Maker, the automated machine which can be powered electrically, to operate using electro/ mechanical principals based on electrical, electronic and mechanical. It has been designed to be manufactured or fabricated using local materials. The design of this project has two- rollers incased in a rolling- section which is the pellet making chamber. It has a ring- die which is driven by a motor. The rolling section is fed by a hopper which is able to hold a large quantity of feed/ material from time to time. This machine has two- sensors, one installed on the hopper and the other on the rolling- section to sense feed- level and control the motor on the hopper, controlling feeding mechanism from the hopper into the rolling- section.

The main parts of this innovation are; the hopper, rolling section, die, two- rollers, two- motors and 2- material (feed) sensors.

Introduction and Background

For many years, the art of pellet making came about in an environment that was lacking proper understanding of what occurs when the feed ingredients are subjected to the pelleting processes of heat, moisture, and pressure. This science of processing grains helps to determine the characteristics of feed (moisture, content, fiber, etc.) and using machinery with accurate measurements, converting feed material to pellets.

The Auto Pellet Maker is mainly used to produce poultry feed pellets and one of the reasons why poultry/ livestock industry choose pellets is that, with a pellet making machine it is possible to create specific feed blends for specific animals/ birds. This way the animal/ bird feed intake can also be precisely controlled.

The other reason why to choose poultry/ livestock feed pellets is that it enables farmers to add several feed additives (micro-nutrients, mineral and vitamins) to ensure their animals/ birds have a balanced feed that meets their daily nutrient requirement.

Aim

- To make a device or machine that works efficiently and effectively in feed pellet production, reducing feed cost as well as saving time and energy.

Objectives

- To save time and energy (reducing human effort) in feed pellet production with automation.
- To reduce cost of feed pellets by increasing producing as more people venture into feed pellet making business.
- To make poultry/ livestock farming easy to manage by means of automation and increase in production.
- To improve poultry production by encouraging farmers, more especially small scale poultry farmers to produce their own feed pellets.
- To make feed pellet making machines available and accessible to both small and large scale poultry/ livestock farmers.

The purpose of pellet making is to take a finely divided feed material by means of heat, moisture and pressure to form it into larger particles, which usually result in improved feeding results when compared to the un-pelleted feed. Animals make better gains on pelleted feed than a meal ration. The heat produced in conditioning and pelleting make the feed-stuffs more digestible by breaking down the starches, and the pellet simply puts the feed in a concentrated form, and pellet making also minimizes waste during the feeding process. When pelleted feed is fed, each animal/ bird receives a well-balanced diet which prevents them from picking and choosing between ingredients, and by combining moisture, heat and pressure on feed ingredients, a degree of gelatinization is produced which allows animals and poultry to better utilize the nutrients in these ingredients.

The feed conversion and improvement have advantages which are particularly noticeable in the broiler industry. Pelleting prevents segregation of ingredients in a mixing, handling or feeding-process. By feeding a pelleted feed, it provides animals/ birds with a totally mixed ration than the one that has separated through these processes. It also prevents waste, increasing bulk density which enhances storage capabilities of most bulk facilities.

A better flow and handling characteristic of pellets is one of another advantage, particularly as it relates to dairy farmers. The process of producing feed pellets can roughly be described as a plastic molding operation of the extrusion type. Feed ingredients are made up of various compounds such as proteins, acids, sugars, fibers, and minerals. These products can be softened (conditioned) by the addition of heat and water. When sufficiently controlled compression is applied to the “conditioned” feed ingredients, they form a dense-mass which is shaped to conform to the die against which they are pressed. When heat and moisture gets withdrawn, dried and cooled to withstand moderately handling without excessive breakage, and has retained and improved the nutritive value.

MATERIALS/ METHODS/ DESIGN/ METHODOLOGY

Materials / Methods

(Model- Specifications)

- **Power Supply:** 220- 240 volts (domestic/ small scale use) - single phase electricity
: Industrial (large scale) – Three phase electricity
- **Outer size:** Can be made depending on the application, industrial/ Domestic, just putting the dimensions on the right scale.
- **Weight:** Light- weight on small scale as compared to the larger scale.
- **Fabrication/ Construction Material:** **Rolling Section** (Stainless Steel) and **Hopper** (Stainless Steel Sheet)
- **Motors:** Single Phase (on small scale)/ Three Phase (on larger scale)
- **Sensor:** can use 12 or 24Volts

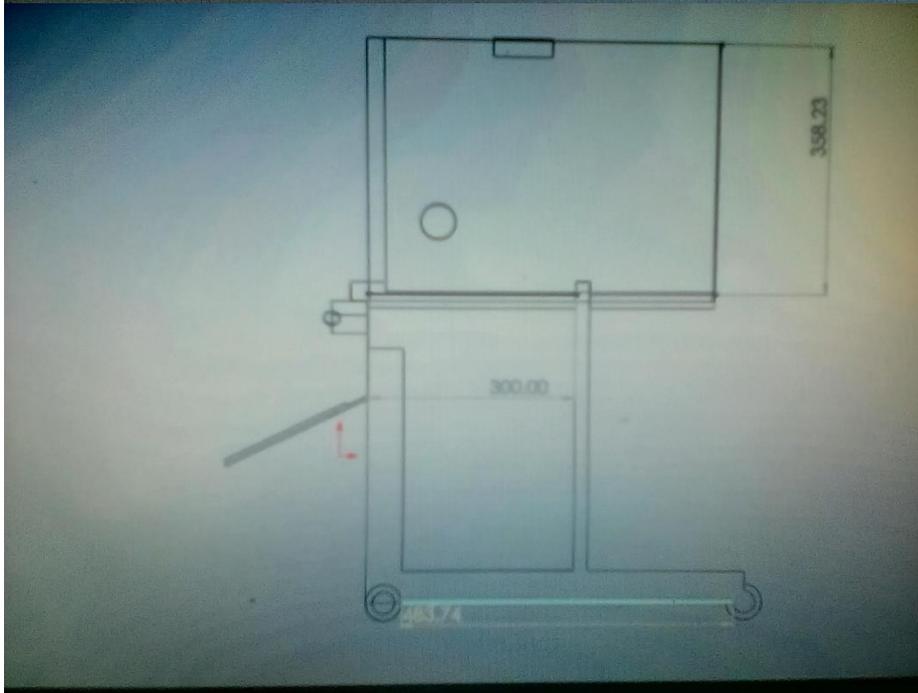
Raw-Feed Material:

Grains powder, straw meal, rice husk, grass meal, sun- flower, etc.

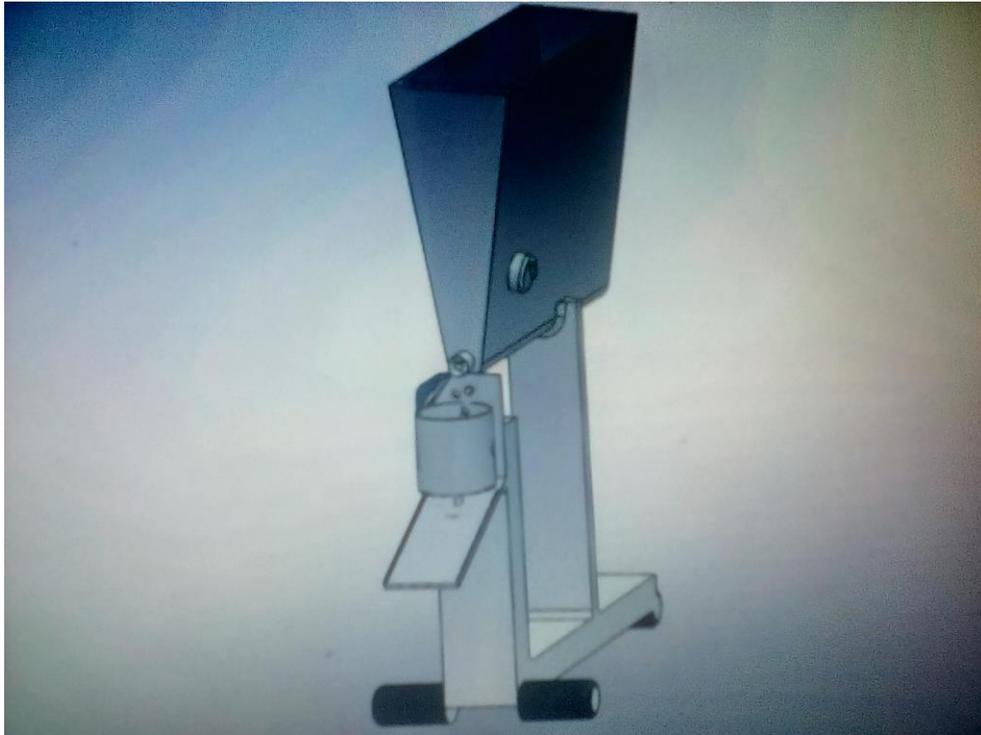
Water Content:

10- 12% approximately on larger scale and less than 10% on a smaller scale.

Design/ Methodology







(Working Principal of the Auto Pellet Maker)

The working principal of this innovation is based on a vertical design, The Ring Die Pellet Making; where materials (feed) fell onto a rolling section.

And then it has material level sensor for automation, on the hopper and on the rolling section (converting material- feed to pellets.)

The design and operation of the ring die pellet maker is positioned vertically. The raw materials are compressed through the die with a series of compression rollers. The design of the Auto Pellet Maker is where the die is powered and rotating, and the rollers move due to the friction and movement of the die. Depending on the raw material one design maybe more suitable than the other.

Advantages of the Auto Pellet Maker

- It can be used to increase feed pellet production
- It can help to make feed pellets available for small/ large scale livestock/ poultry farmers
- It saves time and human effort in feed pellet production (Automation)
- It can function using solar power, especially on small scale which is better for rural operations using 12Volts.

Using Solar Power

Solar energy is a renewable energy that is becoming mainstream due to cost feasibility and high efficiency. There is an increase in the use of solar power for agricultural purposes, and this is because solar power is a reasonable good choice for agricultural equipment/tools.

Most of agricultural equipment work on **battery power** and fuel oil, but the use of solar energy, the battery power is replaced with **solar power** in order to minimize the usage of electricity from grid-power and non-renewable sources.

Advantages:

It is an environmentally friendly way to generate power because they are silent, produce no emission while in use and require no fuel to run them.

The **Auto Pellet Maker** can also be connected to solar power source for several advantages, especially for small scale poultry farmers. Since this project on a small scale can use 12Volts, it can be connected to a **Solar Powered Battery** and this makes it easy for small scale pellets production. Therefore, using solar power to operate this innovation can be environmentally friendly, reliable and cost effective.

In general, Zambia and other African regions are rich in solar irradiance resources and they are available for free. **Solar Energy** is therefore considered as the top choice for rural electrification.

Results and Discussion

The **Auto- Pellet Maker** has been designed to operate automatically, with the control of **Feed Material Sensors** to control the quantity of feed in the **Hopper** and the **Rolling- Section**.

Benefits Realized by using Automation:

Automation is the use of mechanical and electronic equipment to reduce the need for human labor. There are many benefits to automation. Machines can be used for repetitive and boring work. In factories, automation can produce more goods in less time with fewer materials.

Automating processes you experience significant gains in productivity.

The most common and significant benefits include:

Reduce Cost – process automation reduces the need for additional resources. With automation, integration between systems improves reducing the need for human intervention.

This can be accomplished by focusing on requests that do require human intervention and by increasing the predictability of the time it takes to fulfill requests.

Minimize Risk – by implementing repeatable processes, the entire organization will reduce risks associated with process errors. This automation will decrease human error.

Enhance Quality – process adherence improves with automation, processes are consistently followed and produce consistent results.

Pelleting: The heart of the pelleting process is the point where the wedge of feed is between the roll and the die.

There are three areas of pressure: (i) the roll acting upon the material compresses the material into the die, (ii) the die itself has a resistance that can hold back the flow of the material through the holes in that die, and (iii) the pressure which is exerted by the rolls combined with the frictional- pressures of formulation itself. The pressure here keeps the material compressed together, keeping it from squirting along the face of the die in front of the roll.

Increasing the variable speed drive or control and increase the amount of feed into the Pellet Making Machine, the quantity of feed gets thicken in direct proportion in front of the roll. The force that pushes feed- material into the nip point is greater, instead of down into the holes of the die. This action is what makes a pellet mill to plug.

Feed distribution is highly important across the face of the die and into this nip point. Feed distribution is a problem and can cause the pad to be too deep and, again, limit the ability of the roll to force the product into the die holes. This essentially limits the production. This is why it is critical that the rolls be set on a regular basis, remembering that the feed flow through the die is what causes the die to wear away from the rolls. The rolls should be adjusted to a point so that the roll will be allowed to turn.

Pelleting is a daily exercise in ability and knowledge and what is important is having good pellet production with good quality. One needs to understand the process and be able to adjust in a particular day to the ambient temperatures, humidity, formulation changes, and conditions of ingredients, and bound or inbound moisture levels of these ingredients. Operating a Pellet Making Machine is not an easy process and so it has to be a choice for an individual because it can be a challenge.

Conclusion

The Auto Pellet Maker is an effective and efficient machine operating using electrical/ mechanical principals, and it can be used by both small and large scale poultry farmers. Therefore once this design has been adopted it will help greatly in agricultural sector in the area of poultry farming, for the fact that feed cost represents the major item in the cost of animal/ birds production, and efforts must go on to refine feed manufacturing techniques to reduce the cost of feed and to increase its value to the target animal/ birds. In some cases, changes in feed manufacturing technology will be dictated by other motivations such as regulatory guidelines or health concerns. The use of hydro- thermal processes, pellet making using this innovation will add significantly to the cost of feed.

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