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Design and Development of Grain Dryer

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Abstract - The purpose of the paper is to Design grain dryer to remove the moisture from the grain. The paper gives you the detail about the storage of the grains for long time by removing moisture, which can adversely affect the grains and its quality. By accomplishing the aim of the project one can store the grains for longer time also which can be easily acceptable in the market. If the moisture content is present in the grain then it is not suitable for long time storage and further process. If the grains have lot of moisture content then it can spoil the grains. This paper gives the solution for the limitation of natural sun drying or natural air drying which is time consuming process. The sun drying or natural air drying is a conventional method to remove the moisture from the grain, as it takes much time, more space and more labour. In the dryer, the heated air from the blower is passed through grain-bed that means it passes through conveyor belt at the same time, the warm air at limited temperature provided and moisture is reduced from the grain. After that the dry grain is to be transferred automatically in collector, the net separator is present in between collector and conveyor belt. If the grain become dry it can be protected from grain spoilage, it is portable unit so that it can be moved from one location to another location.

Key Words :- **Heater, Grain dryer, Blower, Conveyor, Drying process, Collector.**

1. INTRODUCTION

India produces about 260 million tonnes of food grains per year. The major components of production are 95 million tonnes of wheat, 105 million. tonnes of rice, and 18 million tonnes of pulses, Cereals (Anon. 2015). Due to technological advances in agriculture and the introduction of high-yielding varieties, this may increase. From this production, an average 10% is lost during post harvest operations between the field and the consumers. This means that about 15 million tonnes of food grain, valued at about $A240 million (Indian Rupees 2400 million) goes to waste. The major share of the loss occurs during storage of surplus stock. Among the various causes of losses, the most important one is improper drying before storage. The preservation of agricultural produce by drying is a long established technique. Sun drying in the open, on mud-plastered or concrete floors, is the conventional method of drying grain and also cash crops like chilies, and plantation and horticultural crops. The drying time required in the open sun for these crops ranges from 5 to 45 days depending upon the crop to be dried. Unfavorable weather conditions are likely to occur during the drying period and degradation in quality of the final produce therefore becomes unavoidable. Annual postproduction losses by crop in India, expressed as a percentage of total production, are estimated to be as follows: wheat, 8%; pulses, 9.5%; and all food grains, 9.3%.

It is well-known that deterioration in quality caused by improper drying cannot be eliminated until improved drying systems based on mechanical dryers have been adopted. However, for many reasons, these systems have not been adopted. The main reason that is encountered is a lack of organizational or government incentive to the farmer to deliver a quality product that might command a premium price. This result in not only a negative attitude, but also leads to the overall quality of the product gathered at market points being alarmingly poor.

A second important reason for not using dryers is their high initial costs. Most of the commercially available dryers are designed to suit the needs of the processing industry and their output capacity is therefore far above the needs of individuals, or even of farmer groups. An awareness of availability of dryers and of their use and advantages in drying food grain for better storage and marketing is lacking among crop growers This paper describes the use of various types of dryers in the Indian food industry and the efforts of research and development organizations to devise dryers suitable for individuals or small groups in the rural population. However, even with properly dried grain, scientific storage remains important and recent advances in developing various storage structures are also described.

2. LITERATURE SURVEY

- **Grain drying - Dr. kenneth J. Hellevang (Extension Agriculture Engineer) :-**This paper describe the how much amount of percentage of moisture content present in the grain also how much amount of percentage is required for suitable for long time storage and short time storage. (long term storage = more than 6 month, short term storage = up to 6 month).

- **Overview of grain drying and storage problem in India- Javed Ali: -** In this research paper we have studied how much amount of food grain produced in India and the method for drying the grain which is used by Indian people and the problem related to storage of grain. This paper describe the various types of dryer in the Indian food industry and what can be done to minimize the losses of food grain with the help of various scientific drying method or different scientific storage structure.

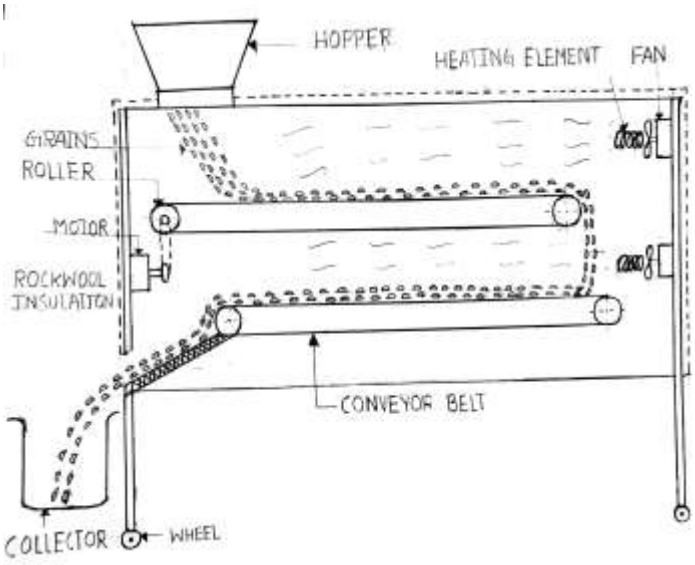
- **Design and evaluation of solar grain dryer with a back-up Heater - K. S. Tonui: -** This paper describes the study of design of solar grain dryer integrated with simple biomass burner. The backup heater is used to improve the thermal efficiency of solar dryer.

- **Grain drying system - Dr. Drick E. Mainer:-**This paper is described the different types of drying method used for drying grains also how much amount of heat is safe for grains.

- **Automatic control for maintaining equilibrium, temperature/moisture between stored grain and atmosphere - Sylvester L. Steffen.**

- **In-Bin controlled atmosphere, grain drying system – James R. Hotovy: -** In this research paper we have studied the natural air drying system for grain storage bins where in proper amount of moisture is required for grains.

3. DESIGN OF PROJECT



4. COMPONENTS

HOPPER: The hopper is a funnel shaped device which is used to feeding the moisture content grain in machine. it is made up of metal sheet and is used for feeding the grains. The hopper which we are using is made by hard rolled sheet also it is used to feed the machine continuously by moisturized grain.

ELECTRIC MOTOR: An Electric DC motor is a motor which converts electrical energy into mechanical energy. The working of DC motor is based on the principle that when current carrying conductor is placed in magnetic field, it experiences a mechanical force and due to this conveyor belt is run.

CONVEYOR BELT: Conveyor belt is a carrying medium, it is used to carry the grain from one side to another side. the conveyor belt which is used in our project is made by galvanized sheet. It is flexible and the temperature cannot effect on material of conveyor belt.

ROLLER: Roller is used to support and run the conveyor belt. it is made by CI material. The roller is of hollow and cylindrical shape. The conveyor belt is wound on roller.

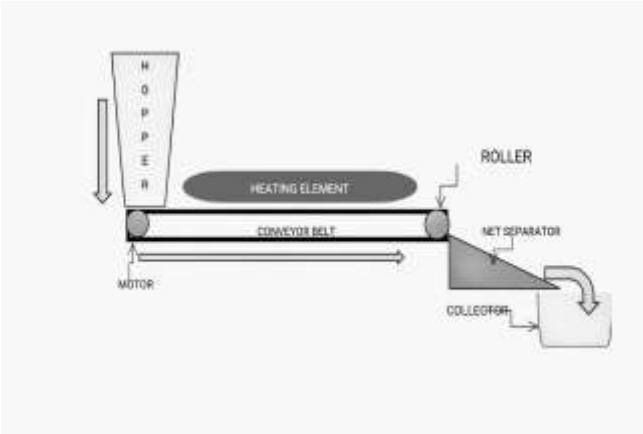
FAN AND HEATING ELEMENTS: Fan and heating element used to provide hot air to the grain. high speed RPM fan is used to provide the air in the machine & heating element is used to provide warm air into the machine.

NET SEPARATOR: The unwanted particle and impurities is present in grain so net separator is used to remove all the impurities from the grain

5. WORKING METHODOLOGY

After harvesting the grain content more amount of moisture in it. That's why moisture content grain are not safe for storage and further processing purpose & it not give good market value. so to overcome this problem we are design this grain dryer for drying purpose.

Firstly, moisture content grain is feeding in hopper then the grain is transfer on conveyor belt. And conveyor belt is rotated by using motor and roller. the grain is on conveyor belt is move from one position to another position at that time we are providing heating air at limited temperature by using fan and heater the grain is to be heated. And that's why the moisture is removed from the grain. After that the dry grain is to be transferred automatically in collector. In between collector and conveyor belt we provide net separator for removing unwanted particles and dust.



6. APPLICATION

The main applications are that it can be used in Rice mill, flour mill to remove moisture from the grain also used in food industry for drying purpose. Grains are more easily dried and give the good quality of grain and can be kept in safe storage. The dry grain, it can be easily acceptable in

market & it gives good value in market. The government warehouse has grain storage in bulk quantity it is very hard task to store much of quantity & that to dried so the project will ultimately help the government as well as farmer so that they may not face the loss especially during monsoon season. Due to unexpected rainfall, rainstorms the grain become wet and due to this the grain will become spoil and we prevent grain from spoilage by using our grain dryer

7. ADVANTAGES

1. After harvesting the moisture is present in the grain & if moisture is presents in the grain it become spoilage for that we deign a grain dryer to remove moisture content from grains.
2. For the purpose of removing moisture from grain less time and space is required.
3. The grain dryer we have design is economical for farmer.
4. The grain can be get protected from spoilage due to moisture present in the grain.
5. The grain dryer is not dependent on weather condition so that it can work in any season.
6. For the process of drying of grain less worker is required.
7. Better control over a temperature and moisture content over a sun drying.
8. It is portable unit, it can move from one location to another location

8. CONCLUSION

From this paper we have conclude that the government warehouse has grain storage in bulk quantity it is very hard task to store much of quantity & that to dried so the project will ultimately help the government as well as farmer so that they may not face the loss. The project is prevent the grain from spoilage by removing moisture from grain within less time, less space, & less labour. The machine is portable so it is move from one location to another location so it beneficial for farmers.

REFERENCES

[1] Dr. Kenneth J. Hellevang, "Grain Drying" .Extension Agriculture Engineer. 2013

[2] K.S. Tonui, E.B. Mutai , D. A. Mutai *"Design and Evaluation of Solar Grain Dryer with a Backup Heater"* 2014

[3] Sylvester L. Steffen, *"Automatic Control For Maintaining Equilibrium / Moisture Between Stored Grain and Atmosphere*. 1977

[4] Javed Ali, "Overview Of Grain Drying and Storage Problem in India." 2015

[5] AR Yadollahinia, "Design and Fabrication of Experimental Dryer for Agriculture Product," *2008*

[6] Pietro Fasano, "Grain Dryer," *1981*

[7] James F. Buffington, "Grain Drying Apparatus and Process"1997.

[8] Ajay, K.S. Sunil and d. Deepak "Design of solar dryer with turbo ventilator and fireplace".2009

[9] Bena B. & R.J. Fuller "Natural convection solar dryer with biomass backup heater" 2002.

[10] Jindal, V.K. & S.Guanaseekaran "Estimating air flow and drying rate due to natural convection in solar rice dryer" 1982.

[11] Sodha , M. S.,N.K Bansal " Solar crop drying" 1987

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