"DESIGN AND DEVELOPMENT OF WATER SPRAY CLEANING AND GRADING OUT POTATOES ACCORDING TO SIZE"

A PROJECT SUBMITTED TO

SMT. S. R. PATEL ENGINEERING COLLEGE,
GUJARAT TECHNOLOGICAL UNIVERSITY

THE PROJECT ASSIGNED TO SEMESTER (8^{TH}) OF

BACHELOR OF ENGINEERING
IN
MECHANICAL ENGINEERING

SUBMITTED BY

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UNDER THE GUIDENCE OF

Prof. Sumit Kumar

DEPARTMENT OF MECHANICAL ENGINEERING
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GUJARAT TECHNOLOGICAL UNIVERSITY, GANDHINAGAR.

(MAY, 2016)

DEPARTMENT OF MECHANICAL ENGINEERING

Smt. S. R. PATEL ENGINEERING COLLEGE

At & Po: DABHI, Ta: UNJHA, 384170,

DIST: MEHSANA[N.G.]

Certificate

This is to certify that we have examined the project entitled

"DESIGN AND DEVELOPMENT OF WATER SPRAY CLEANING AND GRADING OUT POTATOES ACCORDING TO SIZE"

Being submitted by

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Are Undergraduate Students of Mechanical Engineering We hereby accord our approval of it as a study carried out and presented in manner required for its acceptance in Partial fulfillment of the project assigned to Final Semester (7th) for which it has been submitted. This approval does not necessarily endorse or accept every statement made, opinion expressed or conclusion drawn as recorded in this project. It only signifies the acceptance of the project for the purpose for which it is submitted.

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Certificate of examination

This is to certify that the work presented in the Project Entitled

"DESIGN AND DEVELOPMENT OF WATER SPRAY CLEANING AND GRADING OUT POTATOES ACCORDING TO SIZE"

Has Been Carried Out By

The project assigned to Semester (8th) of

BACHELOR OF ENGINEERING
In
MECHANICAL ENGINEERING

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Of

Gujarat Technological University, Gandhinagar during the academic year 2015-2016

External Examiner	**Internal Examiner**
DATE: _____	**DATE: _____**
SIGN: _____	**SIGN: _____**

ACKNOWLEDGEMENT

First and foremost we are grateful thanks to almighty God. Our deepest regards and greatest admiration remain to my parents & family, who has taught our how to walk on an untrodden path in the quest of knowledge.

I would like to express my deep sense of respect and gratitude our guide **Prof. Sumit kumar** of Mechanical Engineering Department, SRPEC, Dabhi, who have never failed to help our to get a grasp on the subject.

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Very special thanks also to other friends who had guided and helped us a lot with the project. Not to forget, we would also wish to thank all of our lecturers who had given their full co-operation. They had never hesitated to share knowledge and opinions in ensuring the project be completed successfully.

Also, we would like to thanks our librarian, all non-teaching staff and other all.

Thakor Bakul K.	**110780119095**	**Sign……**
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CONTENTS

CHEPTAR 1: INTRODUCTION

1.1 PROJECT BACKGROUND

Potatoes(solanum tuberosum) is considered as strategic and staple food product in India because of its high nutritional value and being a source of starch and different proteins. Sometimes potatoes are also called 'king of vegetable' in vegetable field according to survey, India are approximately tones potatoes are produces. In Gujarat, approximately 70% potatoes are produces in only Banaskantha area. So in this area various cold storage and half baked frozen potatoes factories are available for potatoes storages. Mostly farmers are growing the potatoes and after the last before the selling to be required the sorting of the potatoes as per sizes basis and classified sizing purpose.

However the majority of potatoes production in India. Find its way in the market and it is used at homes and restaurants for the purpose of supplying consumers nutritional requirements. Each one of these types of potatoes in terms of quality, shape and size. In this condition potato size grading and sorting machine are required for classified different grade of potatoes.

Today, manual sorting and size grading method are used by some farmers. In addition to being subjective is costly and time consuming and in this method have required lot of man power.

In our invention related to potatoes sorting and grading machine as per size and the main objective of our project is to provide a simple, efficient, easy to operate and less time consume operating device are to develop in agriculture field. In addition main purpose of our invention is to dedicate this semi automatic machine to the farmers in agricultures field and increase saving time for farmers and cold storage labours cost and also reduce human effort and work wedge shortly there are the lot off economical beneficial to the farmer.

1.2 SCOPE OF PROJECT

1.2.1 WHY WE SELECT AND DEVELOP?

Today, some farmers and cold storages labours are used in manual sorting and size grading method. In this method are time consuming, costly and less efficient and less accuracy. In this condition, our project team are to analysis and define problem and then to generate and create new ideas. So, we have to decide and develop new potatoes size grading and sorting machine. In this machine are more efficient, high accuracy for sizing purpose, less costly and less time consuming. In addition, the main advantages of our project are easily and smoothly operate prototype machine by less skilled labours.

1.2.2 WHAT IS DONE IN THIS PROJECT?

That is past challenging parts for our team.

Planning have been completed so most important point of views has been implements? How to develops this mobility's type of prototype machineries?

More tough situations to become the machines but we consideration only output, how to achieved? In which form to be achieved? And it's answer is to be sorted out as per size basis.

As per the output to generate the whole mechanisms and planned to be succeed to be solve out the whole problematic situations.

1.3 PROBLEM SUMMARY

1.3.1 PRESENT SCENARIO OF FARMERS RELATED TO THE PROJECT VISION.

There are two pictures shown in below. Picture (1) shows that one templates type device with one hole. In this hole size is 45 mm diameter. Picture (2) shows that manual measuring of some potatoes by one labour. In this templates type device has to indicate to sorting out the potatoes as per sizes and which is in form of 45 mm above & below sizes of potatoes. In above sizes of potatoes are use to make a potatoes related items like wafer and below size of potatoes use for cropping purpose. In this method, so much more labours are required and more time also required to complete the whole procedure and it's a very laborious process, costing of the procedure is also high. At last how to solve out the whole process is most important. It's mean how to handle the whole process.

1.4 OBJECTIVE OF PROJECT.

1.4.1 SOLUTION OF PROCEDURE.

Farmers uses automatic type of machine to quickly work is to be done without consumes hard work, to solve out the laborious procedure, improve the efficiency of whole procedure. Automatic machine to be sorting out the whole potatoes quickly. We have uses in this project crank lever mechanism with help of motor, is to be given the power instead of tractor.

In mostly agriculture stages required tractor to be robust and multipurpose uses. In this project also uses the tractor but it's semiautomatic prototype of machine. So, that required motor to give power transmit.

As per our planning this machine will be work on the same as threasure machine, but some different mechanism uses in this machine to get desired output as per requirement.

1.4.2 DRAWBACKES OF PRESENT SCENARIO

It's mostly unfavourable condition for the farmer because more drawbacks required in present scenario.

POINTWISE DRAWBACK AS BELOW

- Higher time consuming process.
- Mostly laborious process.
- To be required more workers.
- Sorties of the worker in field of agriculture, because workers are not willingly in this field.
- Agriculture field depend on the season and consuming the more time for sorting it's harmful for potatoes during monsoon.
- To be taken the care during sorting time because worker is not worked trustable.
- To be given the facilities of midday meal of the workers, so that's the extra expensive.
- Arrange the facilities of the transportation of the workers.
- It's costly process.
- Some time worker are not complete the farmers target in a day. So this is loss condition of farmers.
- At last farmers work very hard, to be need the activeness and notice very careful the workers activity. So that it's time consuming process for the farmers.
- More give the wedges of the workers.

1.4.3 HOW TO SOLVE THIS DRAWBACKS

"How to solve out this drawbacks is a major issue" because this is most important question to give one clue due to solve the whole process. Automation is solution of thee whole process. Automation is solution of the whole process. Automation is to be remove the whole difficulties Basically agriculture field deserves the automation. Due to the automation whole agriculture field works very quickly is to be completed. And its required more in this field. In short factors is whole solution of difficulties. In this modern time automation in agriculture field is powerful techniques.

CHEPTER 2:- LITERATURE REVIEW

2.1 Title

- Potatoes size sorting machine

2.1.1 literature review

- Researchers name:

Abdollah Golmohammadi, Farid Bejaei, Hossein Behfar

- University name:

Mohaghegh Ardabili, Ardabil Iran

- Abstract:

Design & develop a potato sorting machine by means of image processing in the framework of a machine vision project to be use a feeder system, testing a variety of light sources, 6400K fluorescent lamp processed using MATLAB software to separate potatoes, an accelerators system on pneumatic control valves and air pressure was used. That this system is online.

- Using Method:

Adjustable feeder system

- Using software:

MATLAB 2011

- Conclusion:

Comparison between the result of the manual sizing on one hand and the result from this system on the other hand showed that the system has the ability to sort the potatoes based on size with an accuracy 97.4%

2.1.2 Patent review 1

- Inventors name:

Cornelius Barrett Speaks, Of weaver, Kansas

- Input:

Random size of potatoes

- Output:

Suspended for receiving the potatoes as graded and the grader proper is tilted by hand in one direction to separate the dirt and smaller potatoes from those of larger size and in the other direction to discharge the remaining potatoes into the bay.

- Mechanism:

Frame base manual basis crossbar mechanism

- Conclusion:

Grader operated frame basis machine with attach spring supported bar pivoted to framework and bearing at, their rear end grader sliding the blocks. Side block mounted on rods, clamping nuts the rods and nuts. Framework carrying a crossbar at one end, a stationary inclined sized at the other and mechanism support by a bay vertically.

2.1.3 Patent review 2

- Inventors:

Elisha F. Purdy, Paul J. Speicher, Urbana, Indiana (US 952213)

- Input:

Random size of potatoes.

- Output:

Separate the different sizes or grades of potatoes and deposit each size or grade upon receiving grates from which they are swept off and deposited into different receptacles, also to provide separating dirt and other foreign matter from the potatoes before depositing then into their respective receptacles.

- Mechanism:

Sprocket shaft type chain conveyor.

- Claim:

With a hopper stationary bed consisting of a series of longitudinally. bars tapering wheel situated at or near forward ends to rear ends sprocket shafts wheel situated at or near forward ends to rear ends. Grates situated under and parallel on sorter bars, conveyer chain passing on sprocket wheel and arranged to transverse from the forward to the rear ends over the top surface to said sorter bars and rewarded to the forward ends over the top surfaces of said grates

2.1.4 Patent review 3

- Inventors:

John M. Gunn, Minnesota, Ottertail(1163910)

- Input:

Random size of potatoes

- Output:

Potatoes deposited within in a revoluble cylinder which latter will discharged the smaller potatoes on to a stationary screen remove foreign matter from the potatoes fed on the said screen, clean the potatoes in to receptacle.

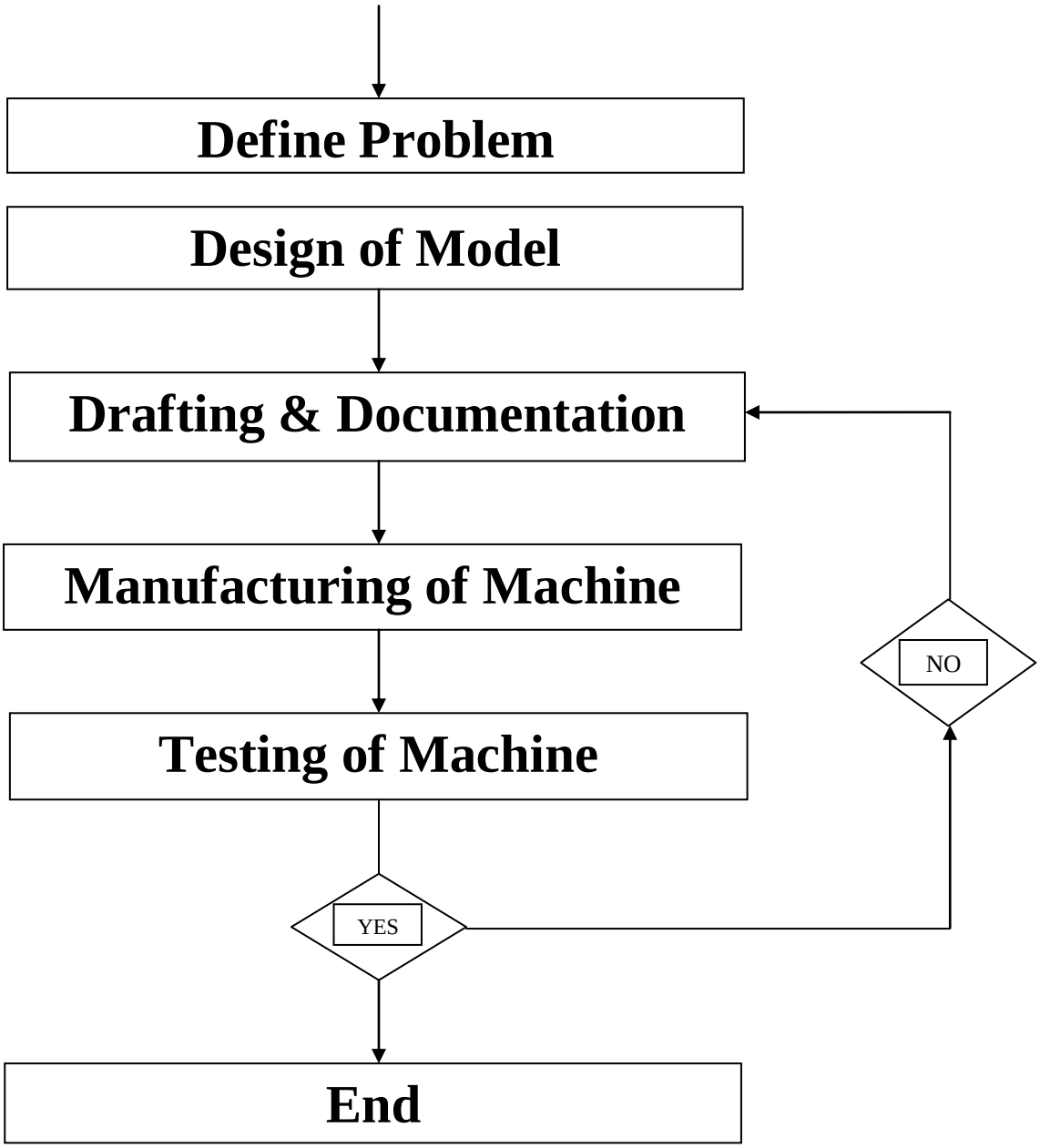
- Mechanism:

Revoluble cylinder manually operate.

- Claim:

Cylinder rotatable mounted and formed transverse slots so spaced retain within cylinder potatoes of a large size allowing discharge of potatoes smaller size, potatoes also cleaned by engagement one with the other and with the platform slots, during their gravitating movement potatoes move inclined platform.

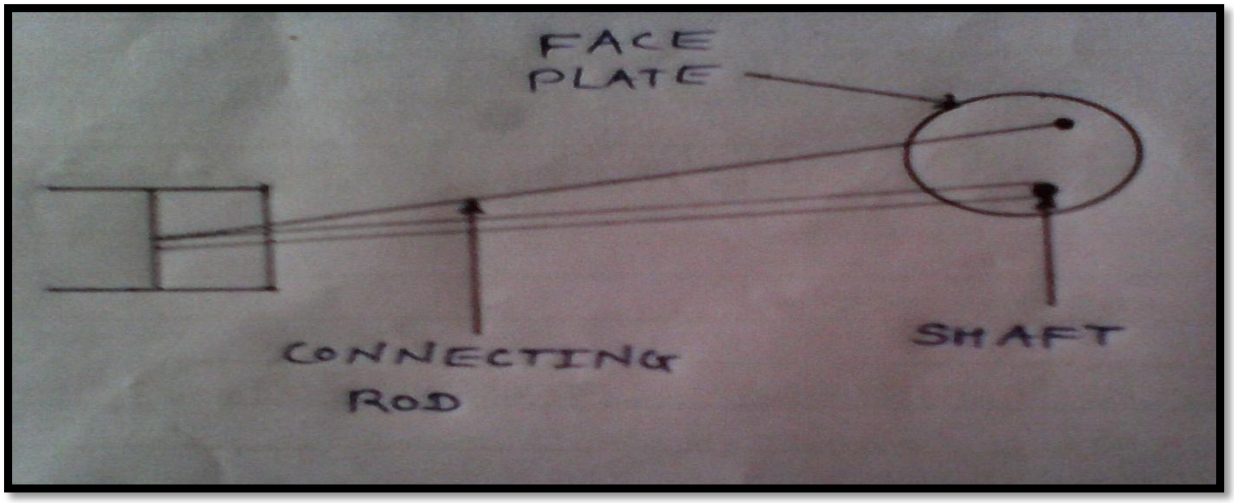
CHAPTER 3: METHODOLOGY


Define Problem
Design of Model
Drafting & Documentation
Manufacturing of Machine
Testing of Machine
NO
YES
End

CHAPTER 4: DEVLOPMENT OF MACHINES

4.1 WORKING PRINCIPAL OF MODEL

In our invention semi automatic agriculture potato sorting machine, according as per size works as a 'crank lever mechanism' or 'reciprocating power transmission mechanism'.



[FIG 4.1 :- WORKING PRINCIPAL]

In this mechanism, first off all we have rotate face plate by pulley shaft at that time power to transmit pulley to face plate. In addition, connecting rod is to connected & fitted with eccentric pin to the face plate. So, we have easy to understand at that time connecting rod has also reciprocating of them and wooden structure is also reciprocating and potatoes easily sorting out as per size basis.

4.2 DISCRIPTION OF THE PROJECT MODELS

That's are challenging situations to find out the difficulties and mostly the agriculture is a very tough field to solve the difficulties. Because without the human effort is not to be done.

We are considering the how to achieve the output, we was find out the two to three mechanism to run out the whole machine but at last to analysis the mechanisms, we are get better result as base on planning, and it's also affordable pricing by farmer and manufacturing very easily.

The name of mechanism is "**crank lever power transmitted mechanism**". It's very easily process. It's also same as thresare mechanism but required some changes occurs in this mechanism to get perfect planning of output.

We have been completed the drawing of this model and solve out the difficulties in this machine. Most important factors is reduce the speed of motor to machine.

- **Construction:**

Semi automatic agriculture potato sorting machine ass per size as shown in fig.(4.2) In our invention one kind of prime mover to select the single phase A.C. induction motor to give power of machine system. Basically, in this motor rotor at 1500 r.p.m. but, this speed is very high for machine system. So, this speed is reduce necessarily. So, we have to select the belt & pulley system.

However we have to select four kind of pulleys different inches respectively, for speed reduction purpose. In pulley & belt system, least pulley are connected to face plate and face plate are also connected to the connecting rod with eccentric pin. Other side of connecting rod connect or join to the wooden structure. If the wooden structure supported by supporting member and fulcrum type system very helpful to hanging the structure on the supporting member.

In wooden structure there are two sides used. upper side sieve use to perforating type. The perforating is the process of making a large number of very small holes close to each other in the plate & lower side sieve is use without hole. Both the sieves are fitted in wooden structure with the help of screws & bolts.

Top most portion of wooden structure is known as 'hopper'. This hopper was clamped and supported by the supporting members.

- **Working:**

when single phase induction motor rotate at 1500 r.p.m. at that time pulley system has also rotates for reduction of speed. Then after least pulley connected to face plate and face plate also rotates. In addition, connecting rod is joining the face plate. So, that connecting rod with eccentric pin have reciprocating motion. In this motion will very helpful to motion of the wooden structure. This process is continuously, so the sorting out the potatoes easily with the help of in this method.

We will be use addition arrangement in this project like water cleaning process to clean the potatoes with help of water spray to remove the sand particles. This process will be most important as per demand of the process.

We will be use pedal arrangement system with help of helical spring to press the foot pedal to compress the spring and then remove the foot then return original position. To open the get of potatoes in output into the sieves.

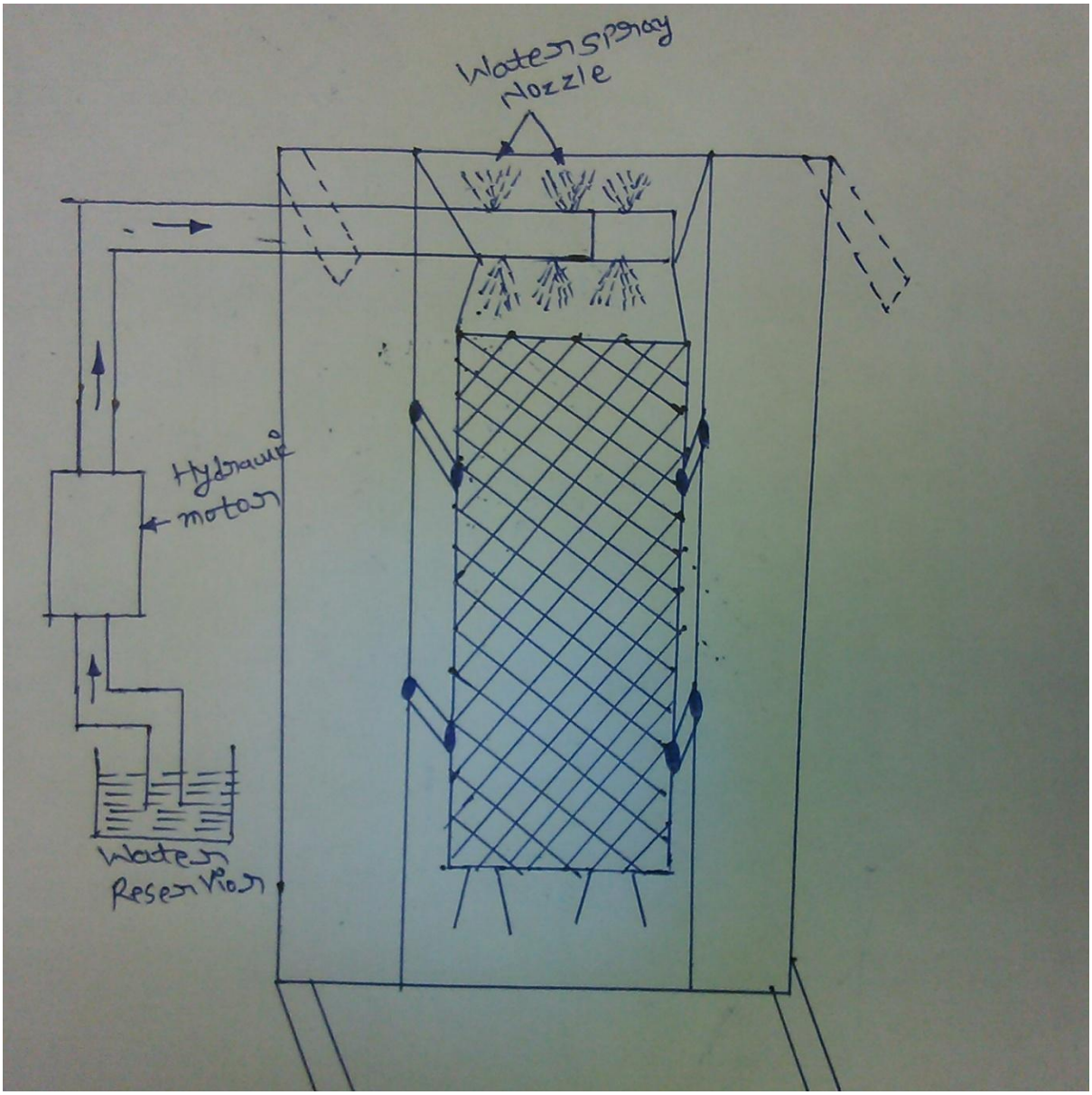
[FIG 4.2 :- HAND SKETCH OF MODALS]

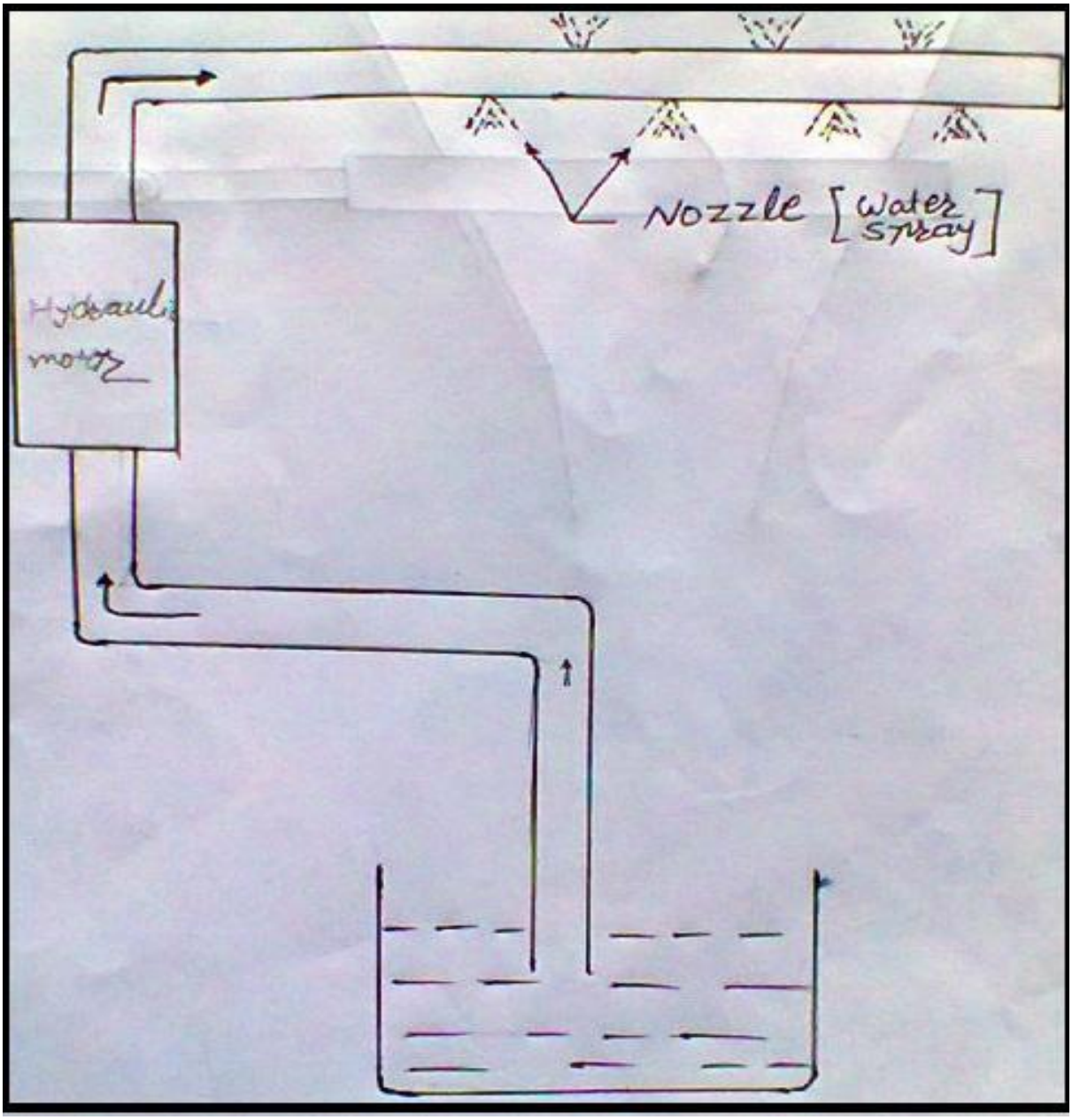
4.3 VARIOUS ADDITIONAL AUXILIERY SYSTEM

4.3.1 Spray nozzle arrangement system

Water nozzle spray arrangement system to remove send particles on the potatoes surface.

To suction the water into water reservoir with help of the hydraulic motor and to spray on potatoes by nozzle.





[FIG 4.3 :- HAND SKETCH OF WATER SPRAY NOZZLE]

4.4 DISCRIPTION OF MAIN PARTS

4.4.1 MOTOR:

Motor is one kind of prime mover of machine system which is used to supply power.

[FIG 4.5: SINGLE PHASE A.C. INDUCTION MOTOR]

Specification of motor:

- Type of motor: Induction motor
- Phase: Single phase A.C. motor
- Speed: 930 rpm
- Voltage: 12 kw
- Horse power: 0.5hp

930 rpm of single phase A.C. motor to reduce the rpm as possible as per requirement to full fill our desire work.

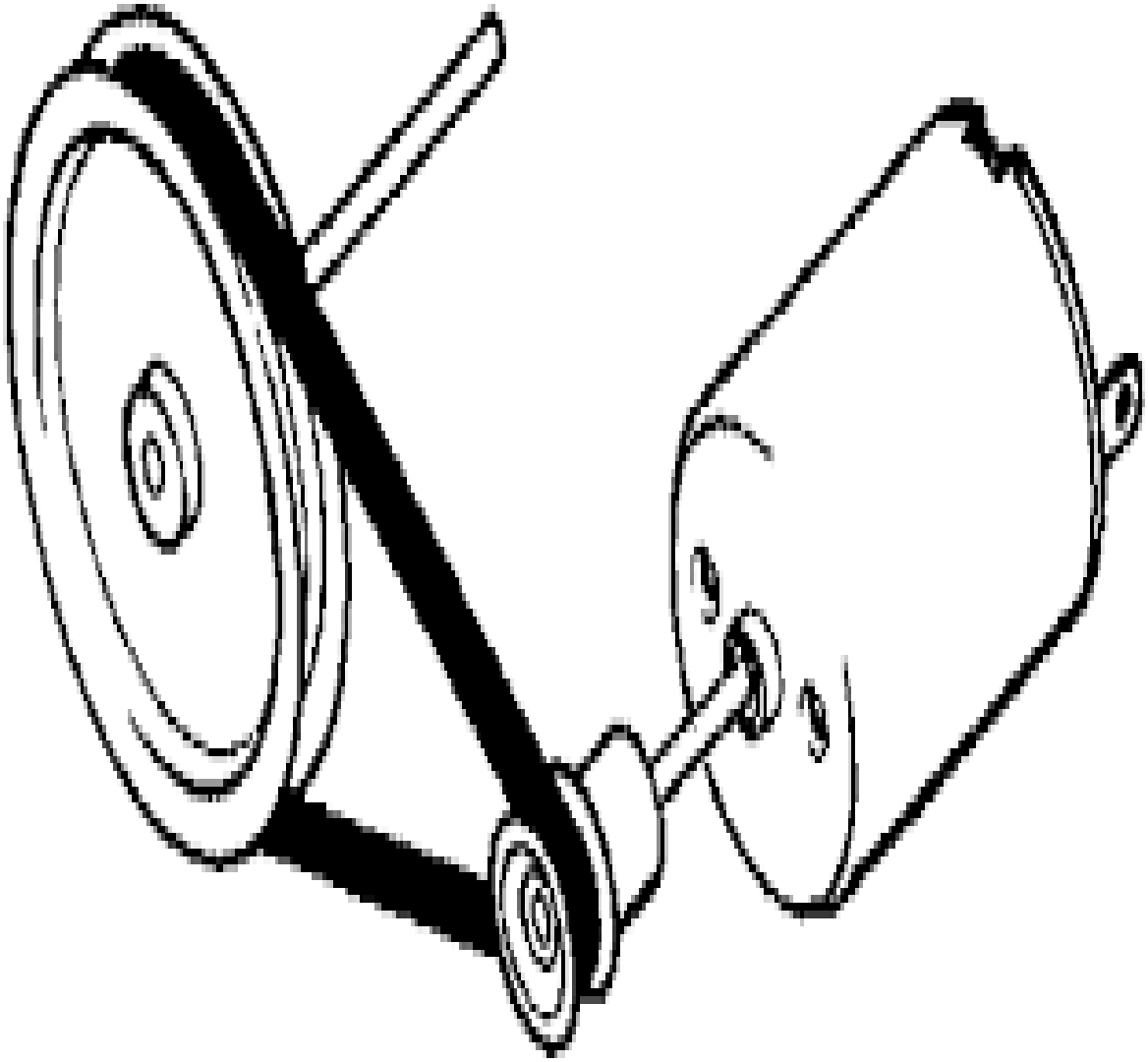
4.4.2 BELT & PULLEY SYSTEM

Belt & pulley system are used to transmitted the power and also used to reduction of speed.

We are used to trapezoidal belt as per standard norms to transmitted the power.

There are different dia. sizes of pulley keyed with shafting to get desire rpm of motor.

In our project, we are used different type of pulleys system.



[FIG 4.6: DIFFERENT TYPES DIA. PULLEY WITH BELT]

4.4.3 CONNECTING ROD :

Connecting rod joint the crank to sieves guide, it is give the rotary motion of the gear to convert the reciprocating motion of the sieves guides and sieves guides simultaneously move in reciprocating form.

Pedestal with shafting as shown in fig.

[FIG 4.7: CONNECTING ROD]

4.4.4 PEDESTAL WITH SHAFTING:

Pedestal are uses for supporting purpose and with shafting used to easily given rotary motion of them.

[FIG 4.8:PEDESTRAL WITH SHAFTING]

4.4.5 CONNECTING GUIDES & SUPPORTING MEMBERS:

Connecting guides & supporting members are connects the two or three sieves simultaneously and give the reciprocating movement , guides also fitted on the sieves and connecting rod joint on the guides.

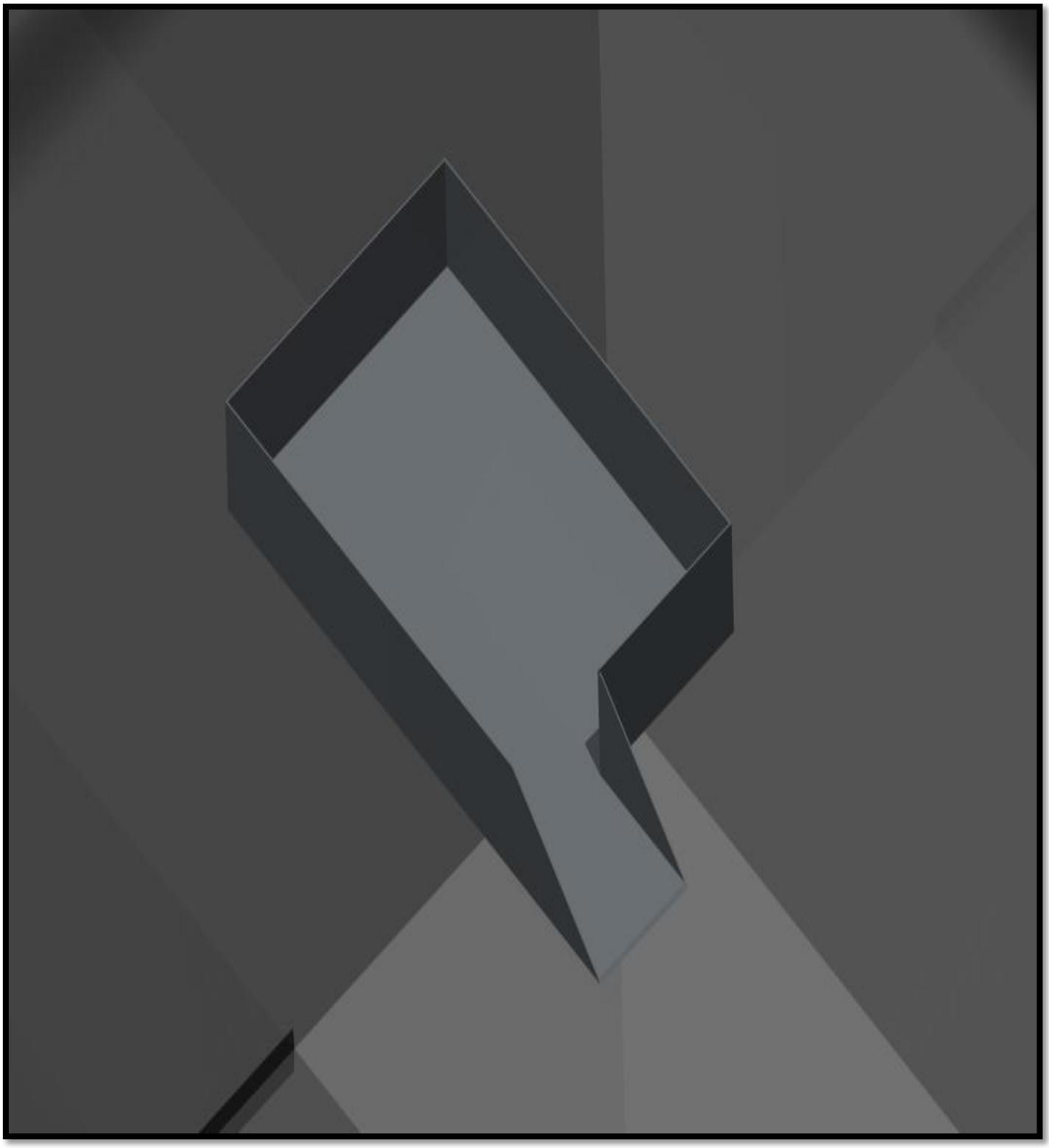
4.4.6 SIEVES:

In our project sieves are classify into two types as follow,

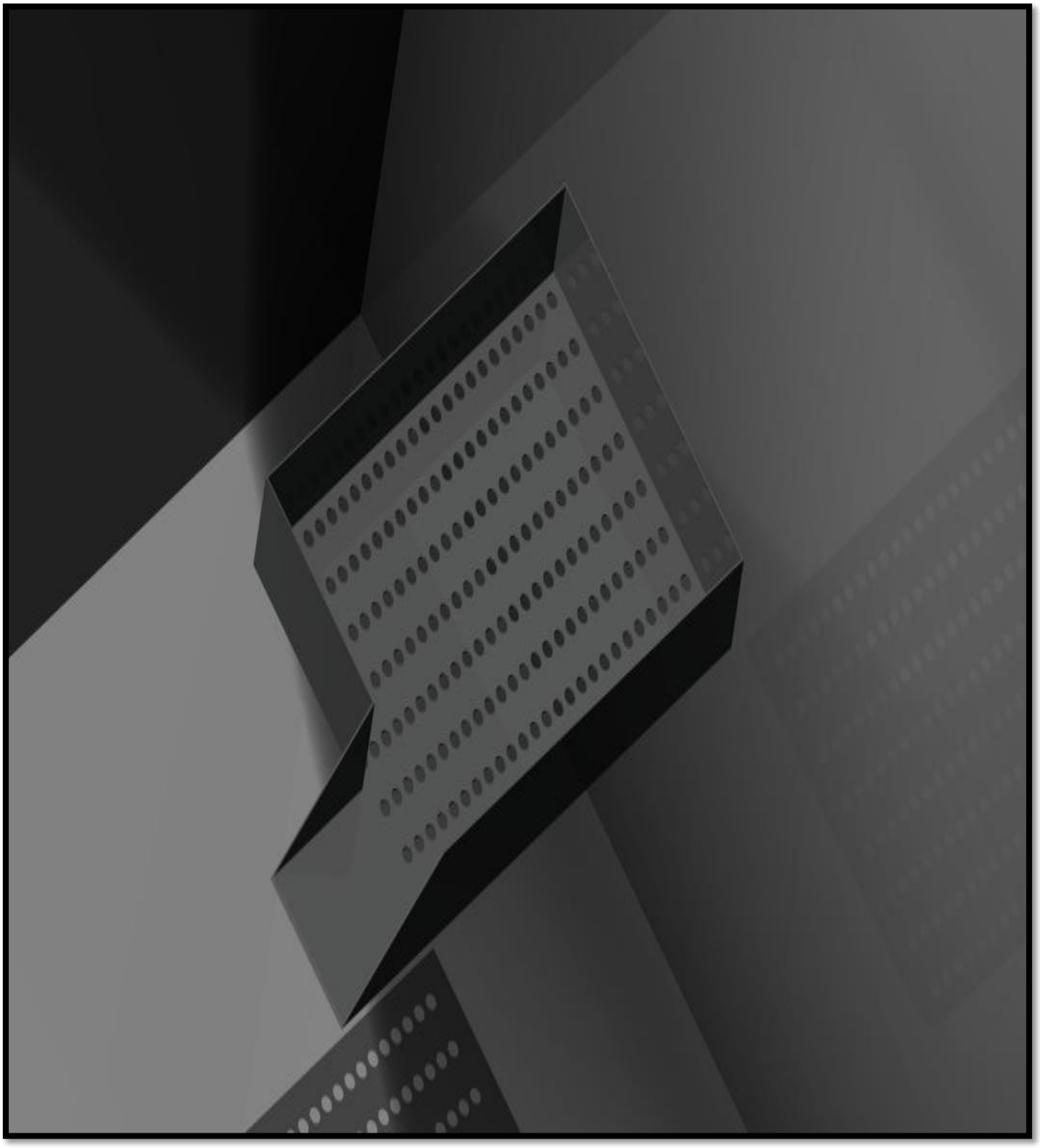
(1) Perforating plate (2) Wastage collector plate

Perforating means the process of making a large number of holes close to each other in this plate. This plate have to locate on upper side of wooden structure and wastage collector plate is locate on lower side of wooden structure.

This two types of sieves are shown in fig. (4.10) & (4.11)



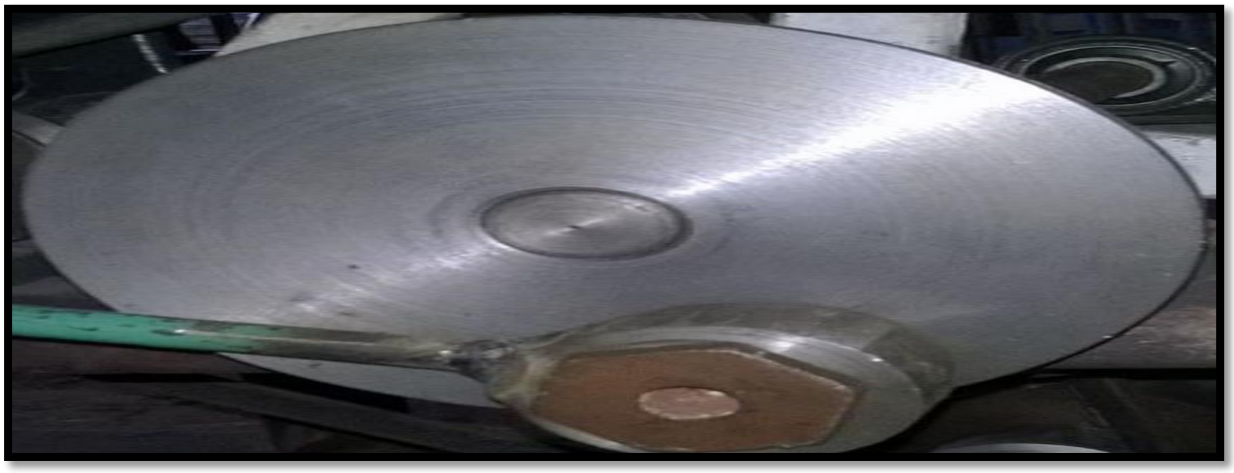
[FIG 4.9: WATAGE COLLECTOR PLATE]



[FIG. 4.10: 45 mm DIAMATER OF SIEVES]

4.4.7 FACE PLATE WITH ECCENTRIC PIN:

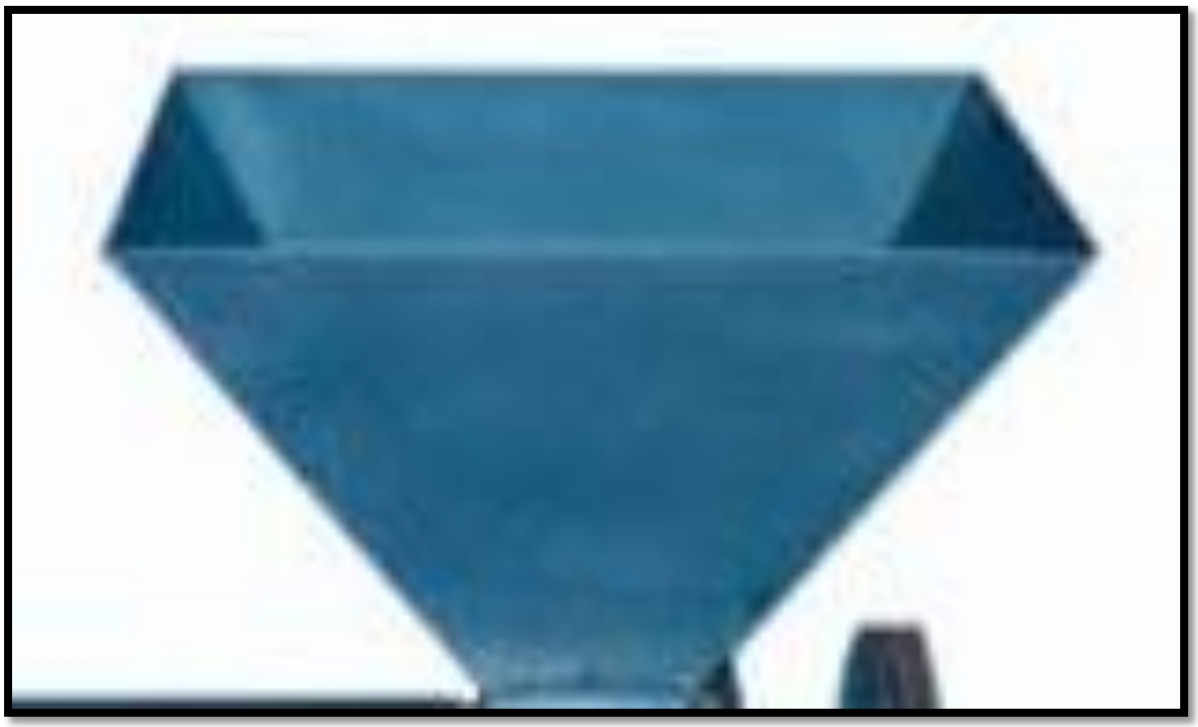
Face plate is used for convert the rotary motion to reciprocating motion with the help of eccentric pin.



[FIG 4.11: FACE PLATE WITH ECCENTRIC PIN]

4.4.8 HOPPER:

Hopper is used in machine for fiddling the potatoes. Hopper is shown in fig.(4.12)



[FIG 4.12: HOPPER]

4.4.9 HYDRAULIC MOTOR PUMP SET

To suction the water into the water reservoir to spray the nozzle on potatoes with help of hydraulic motor.

[FIG 4.13 :- HYDRAULIC MOTOR PUMP SET]

4.5 SELECTION OF MATERIAL FOR MACHINE PARTS:

- We uses different inches pulleys, which is made from C.I material.
- For supporting the machine, we made frame structure from L-section channel, which is made from M.S. material.
- For machine structure, We are using wooden material.
- Sieve plates with different gauges are manufacture from S.S. material.
- We are uses connecting rod, which is made from M.S. material.
- Water spray arrangement system.
- Pedal arrangement system with help of helical spring.

CONCLUSION:-

- Initially investment of machine model will be high, and mfg. Cost of machine will also be high.
- After the completion of model we will concluded that farmers will be operating the machines easily and no extra knowledge required.
- As compared to the present scenario to be used the automatic sorting machine so less effort required for farmers.
- Big sizes of potatoes sorting out top sieves and after small sizes of potatoes sorting out wastage collector solid sieves.

REFERENCE:-

Paper/thesis:

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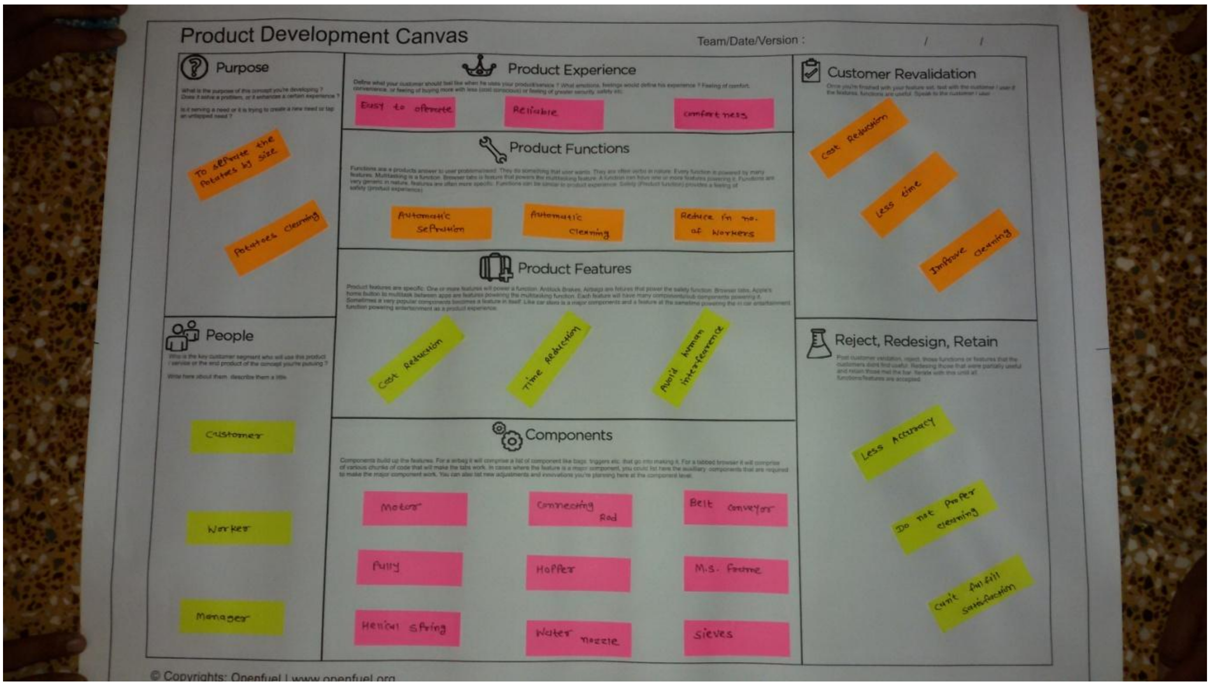
Product Development Canvas
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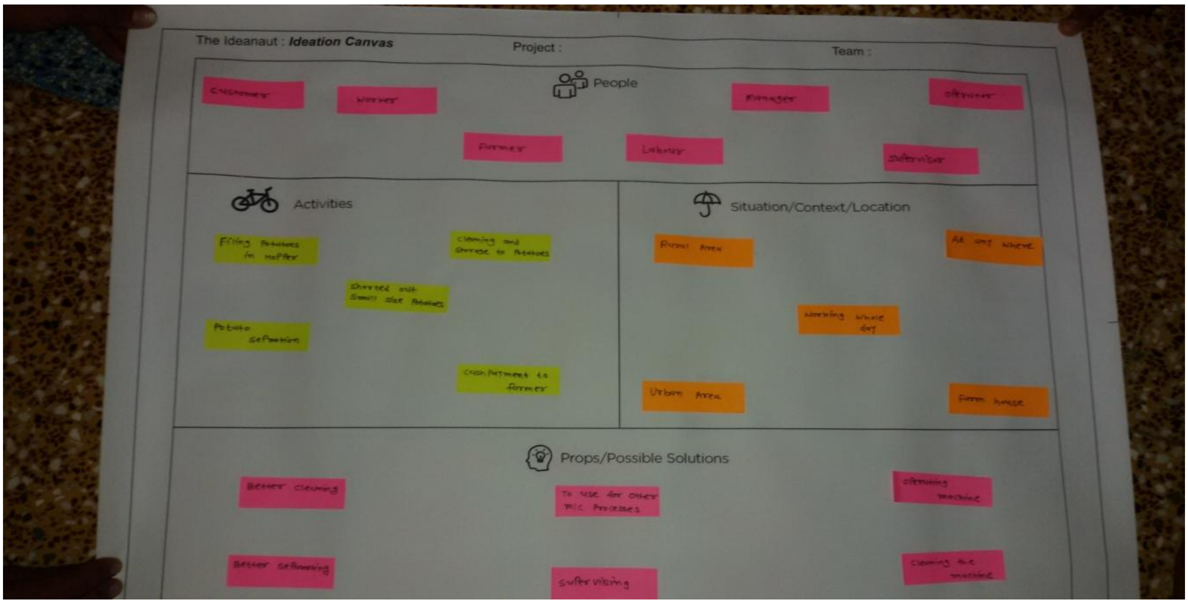
Purpose
To separate the potatoes by size
Potatoes cleaning
Product Experience
Easy to operate
Reliable
comfortness
Product Functions
Automatic separation
Automatic cleaning
Reduce the no. of workers
Product Features
Cost Reduction
Time Reduction
Avoid human interference
Customer Revalidation
Cost Reduction
Less time
Improve cleaning
People
Customer
Worker
Manager
Components
Motor
Connecting Rod
Belt conveyor
Pully
Hopper
M.S. Frame
Helical spring
Water nozzle
Sieves
Reject, Redesign, Retain
Less accuracy
Do not proper cleaning
Can't fulfill satisfaction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Farm house
Props/Possible Solutions
Better cleaning
Better separating
Supervising