Visvesvaraya Technological University

Belagavi, Karnataka-590 018

A KSCST Sponsored Project Report on

"DEVELOPMENT AND FABRICATION OF PALLETS MAKING MACHINE USING AGRICULTURAL WASTE AS RAW MATERIAL"

Project Report submitted in partial fulfillment of the requirement for the Award of the degree of

Bachelor of Engineering in Mechanical Engineering

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Certificate

Certified that the project work entitled**"DEVELOPMENT AND FABRICATION OF PALLETS MAKING MACHINE BY USING AGRICULTURAL WASTE AS RAW MATERIAL"**carriedout by **YASHVANT M. PATIL,(USN 2AG13ME056),ARUN V. PATIL, (USN 2AG13ME019),PANDURANG CHOUGULE,(USN 2AG13ME054)**&**KAPEEL DHOTRE**, **(USN 2AG13ME413)**a bonafidestudents of**Angadi Institute of Technology&Management,** in partial fulfillment for the award of **Bachelor of Engineering** in **Mechanical Engineering**Department of the **VisvesvarayaTechnological University**, Belagavi during the year 2016-2017. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the Departmental Library. The project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the said degree.

Signature of the Guide	Signature of the HOD	Signature of the Principal
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ABSTRACT

We are doing project on agriculture field. The aim is to make fossil fuel pallets from agricultural wastage. We can get much agricultural wastage like sugarcane leaves, soya-bean husks, groundnut husks, corn husks, etc., in large quantity. But in generally we are burning this wastage to have new growth in agriculture and we are not utilizing the burnt energy and also the useful bacteria from the soil will die, so we are using this agricultural wastage for our project.

The agricultural wastage is cut into small pieces are in powder form in cutting unit and added with the binder in the mixer to obtain homogeneous mixture. The homogeneous mixture is transferred into the block maker to make fossil fuel pallets which is useful for domestic and industrial purpose.

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CHAPTER 1

INTRODUCTION

Energy is primary and most universal measure of all kinds of work by human beings and nature. Everything what happens in the world is the expression of flow of energy in one of its form. If present population growth trend continues the future will be more crowded than today. The conventional source of energy is depleting and may be exhausted by the end of this century or beginning of next century [1]. Though most of the countries are adopting nuclear energy technology, it requires skilled technicians. It also involves safety factors as the raw material is highly radio active. The benefit of this technology can't reach the rural areas [4].

In the rural areas farmers after harvesting the crops, burn the waste in the field as they are not using it for any further useful work. So large amount of heat energy is lost to environment. Our project aims at making use this agricultural waste.

The aim of this project is to fabricate and model a pallet making machine which uses agricultural waste as raw material and prepare pallets for house hold and small scale industries. Agricultural wastage can be sugarcane leaves, soya-bean husks, groundnut husks, corn husks, etc.

The agricultural wastage is cut into small pieces in powder form in a cutting unit and is mixed with binder in a mixing chamber. This homogeneous mixture is then transferred to a pallet making unit. Once the pallets are ready they dried and further used as per the requirement.

CHAPTER 2

LITERATURE SURVEY

Energy has become a prime requirement for the development of human society. Fossil fuels, crude oil, coal and natural gas that contribute to about 80% of the global primary energy supply [1]. Organization for economic co-operation and development (OECD) accounted that world consumption of this primary energy greatly increased from 3.8 billion tones equivalent in 1965 to 11.1 billion tones equivalent in 2007. At the rate of present consumption the world fossil reserves would be sufficient for the century.

Renewable sources of energy are very important for future of world. History shows that in rural area, people widely using biogas as primary source of energy which helps in future energy crises. Because biogas is made from cow dung which is waste itself and less polluting the environment.

In the rural areas farmers after harvesting the crops, burn the waste in the field as they are not using it for any further useful work. If the former has a Jaggery making unit he uses that waste for getting the heat energy. But the problem he faces is storage of waste and it requires continuous feeding in to the furnace. Labor has to continuously work for feeding in to the furnace.

To overcome these difficulties agricultural waste has to be compressed so it occupies less space in the store. Since the cow dung is available in rural areas it can be mixed with agricultural waste to increase the calorific value And it also acts as binder. A machine has to be fabricated and modeled which uses agricultural waste as raw material and prepare pallets for house hold and small scale industries.

CHAPTER 3

AVAIBILITY OF AGRICULTURAL WASTE

Bio-mass is renewable sources of energy in the form of wood agricultural residues etc. the potential for agricultural residues alone is estimated as 480m with residues from food grains contributing about 100m.These can be burnt directly to generate steam. The problem with agricultural residues is their collection. The potential for application of Bio-mass as alternative sources of energy in India is very great.

Bio-mass is produced in nature through photosynthesis achieved by solar energy conversion. Bio-mass means organic matter.in the simplest form reaction of photosynthesis in the presence of solar radiation represented as follows, In India the crop of sugarcane is cultivated over large scale hectares of land. There is dry sugarcane leaves in the large quantity remaining in the field after crop season over but our formers, does not use these dry leaves properly. He can burn these leaves in the field.at the time of burning the leaves the bacteria present in the soil will die so we can use these waste as raw material for pallets making.

Also other agricultural waste can be used as follows

a) Soya bean husk
b) Wheat husk
c) Mango tree leaves
d) Corn husk

A huge quantity of agricultural residues is available in country which goes waste every year. Against the total agricultural waste which would be around 200 million tones, the actual consumption of the fuel might be around 40 million tones.

CHAPTER 4

OBJECTIVES

Energy is an important input in all sector of any country's economy. Energy crisis is due to two reasons firstly, that the population of the world has increased rapidly & secondly it is scattered of.as the world's finite supplies of traditional fossil fuels are consumed at high rate by continually industrializing world. The use of Non-conventional sources of energy is becoming more important for the future of the planet.

- Our project aims at making effective use of agricultural waste.
- Prepare small pallets or blocks so that these can be used in domestic cooking and for other applications.
- Giving alternative option for the future energy crises.
- Grind agricultural waste and mix with cow dung to
  Prepare pallets.

CHAPTER 5

METHODOLOGY

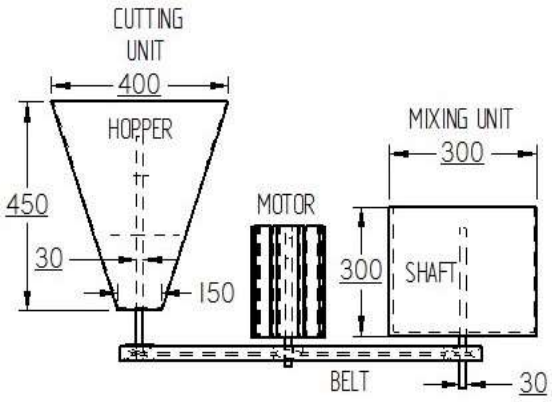


Fig. 5.1 Line diagram of pallet making machine

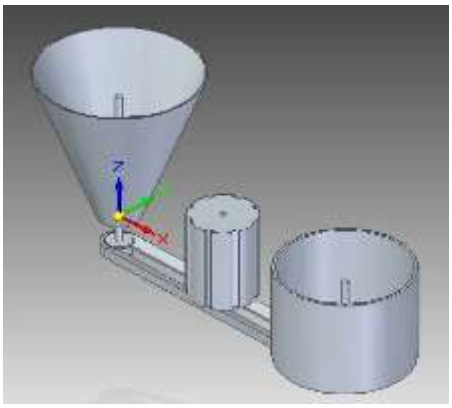


Fig.5.2 - 3D view of pallet making machine

- **Drying of agricultural waste:** originally agriculture waste may be in wet condition. It contains some amount of moisture in it. Burning it with moisture content would produce smoke. So drying is necessary.
- **Cutting waste material**: The agricultural waste material is not in small size for block making we have to cut the material in small pieces /powdered form. Thus cutting machine is required in which material is cut into small pieces.
- **Selection of binder**: Various binders can be used we have selected Cow Dunk as a binding material because it is freely available and low cost. Small amount of low cost, easily available oil can be used. In along with cow dung which act as binder. as well as increase the calorific value of pallets.

We are using COW DUNG as Binder because of following advantages,

1) Cow dung is easily available.
2) It is ecofriendly.
3) Low cost of binder.
4) Less pollution.
5) Adhesive property is better.

DISADVANTAGES OF OTHER BINDERS

Glue: costly, resistance to burning.

Resins: costly, not easily available.

Molasses: costly, rapid burning.

- **Mixing waste material with binder**: Waste agricultural matter which is cut into small pieces is mixed with cow dung in the separate mixing chamber. The mixing chamber has a blades and dimensions as shown in fig. 8.1 and is powered by a motor through belt drive.
- **Making Blocks**: the last step is to make blocks. The fuel blocks are made from homogeneous mixture of waste material and binder. The block may be made various shapes and size. The shape of block may cylindrical, square conical or rectangular as per our requirement in our project we are using block making machine. The homogeneous mixture of waste & binder is taken in the die and some pressure is applied on die material to get compact size, then block is kept for drying.

CHAPTER 6

DESIGN PROCEDURE

6.1 DESIGN OF VESSEL SHAFT AND BLADE [3]

Considerations:

1. Power used (P) = 1.0 KW
2. Speed (N) = 1500 rpm
3. Material = M.S.
4. Shear Stress = 30 N/mm²
5. Bending Stress = 40 N/mm²

Utilization of torque when shaft is rotating

Using relation,

$$P = \frac{2 \pi N T}{60}$$

$$T = \frac{P \times 60}{2 \pi N}$$

$$T = \frac{0.5 \times 10^3 \times 60}{2 \times \pi \times 1500}$$

$$T = 6.36 \text{ N-m}$$

$$T = \mathbf{6.36 \times 10^3} \text{N-mm}$$

The maximum capacity to crush the material in vessel is 250 N.

Suppose we are using 6 no of blades.

For each blade the distribution of torque is given by,

$$T = \frac{6.36 \times 10^3}{6}$$

$$= 1.27 \times 10^3 \text{N-mm}$$

Now consider design of first blade,

Assuming the length of blade

L= 300 mm

w= load acting on the blade

t = thickness of the blade

b=width of the blade

T_1= torque applying on first blade

LDF= load distribution factor = 10.5

Now, LDF x T = W x L/2

$$W = \frac{2 \times T \times LDF}{L}$$

$$W = \frac{2 \times .1.27 \times 10^3 \times 10.5}{300}$$

$$W = 80.70 \text{ N}$$

Now using relation

$$W = t \times b \times fss \times \text{shear factor}$$

Considering b= 20 t

Shear factor = 0.01

$$t^2 = \frac{W}{20 \times fss \times 0.01}$$

$$t^2 = \frac{80.70}{20 \times 30 \times 0.01}$$

t = 2.94 mm

t = **3 mm** (adopting).

Width = 20 x t

= 20 x 3

Width = **60 mm**.

Checking the shear stress of the blade,

T = b x t x L/2 x fss x S.F

$$Fss = \frac{2 \times T}{bxtxl \times SF}$$

$$Fss = \frac{2 \times 1.27x10^3}{60x3x300x.01}$$

Fss = 2.15 N/ mm² (safe)

Similarly using practical data remaining blades

Blade	**length (mm)**	**breadth (mm)**	**thick (mm)**
For 2nd blade	290	60	3
For 3rd blade	250	60	3
For 4th blade	225	60	3
For 5th blade	200	60	3
For 6th blade	200	60	3

Total load acting on the shaft

Consider:

Total length of shaft L_b. = 520 mm.

Total load = $W_1+W_2+W_3+W_4+W_5+W_6$

W_1 = 80 N

$W_2 = t_2 \times b_2 \times fss \times SF$

W_2 = 54

$W_2=W_3=W_4=W_5=W_6$= 54

Total load,

$W= W_1+W_2+W_3+W_4+W_5+W_6$

W = 500 N.

As per simple column theory,

$$W_{cr} = \frac{n\,\pi^2\,E\,I\,e}{L_b.}$$

Where,

W_{cr} = Euler's critical load.

n = end conditions

= Both ends are pinned

n = 1

L_b. = 520 mm

E = Young's modulus = 200.1 x 10^3 N/mm^2

E_c = Euler's constant = 0.00001

I = Moment of inertia

$$I = \frac{\pi \times d\text{^}4}{64}$$

Where d = diameter of shaft

$$W_{cr} = \frac{n\,\pi\,E\,I\,Ec}{Lb.}$$

$$I = \frac{520 \times 500}{1x3.14x200.1x10^3x0.00001}$$

I = 39409.79 mm4

$$I = \frac{\pi \times d4}{64}$$

d = 29.26 mm.

d = 30 mm (adopting).

6.2 DESIGN OF BEARINGS [3]

According to deep groove ball bearing SKF series

ISI no. 30 BC 02

SKF design no 6202

Dia of shaft = 30 mm

D = 62 mm

r = 2 mm

Basic capacity from 10×10^3 N to 15.3×10^3 N

Speed = 1400 rpm

Bearing pressure for unit load,

$P_r = W/2Rd$

$P_r = 500/2 \times 2 \times 62$

$P_r =$ **1.75** N/mm²

6.3 UTILISATION OF POWER

$$P = \frac{2\pi \times T \times n}{10\text{^}4}$$

n = speed in rps.

n = 1300/60

n = 216.6.rps.

Total torque = 6.36 N-m

P = 2π x 6.36 x 216.6/10^4

P = 0.86 KW

But we are using generation of power from motor is **1.0 KW.** Therefore selection of bearings is within limit of power range.

CHAPTER 7

EQUIPMENTS USED FOR PALLETS MAKING MACHINE

For block making we require three types of units.

7.1 CUTTING UNIT

INTRODUCTION

In this machine, the agricultural waste material like leaves of sugarcane, corn husks etc., is cut into small pieces with the help of cutting blades attached to the shaft

DEVELOPMENT OF MACHINE

Basically we have no idea about the material cutting mechanism, we observe the blade of domestic mixer, how the material cut into small material or in powder form. Then we got the idea about the shapes of the blade from the domestic mixture blade. But there is only one blade at the bottom of the flask in domestic mixer. But we have designed to have 5 number of blades placed on above the other in our machine to increase the production rate.

CONSTRUCTION

The structure of the machine is constructed using angles. The overall dimension of the cutting machine including top height and support (1500*1700)mm. The dimension of the parts and drawing of the machine are given in detail.

The stand is constructed with the help of four angles cut like the four feet stand. The cone vessel is constructed from C.R. sheet rest on the stand by welding. The base plate having thrust bearing at the center is permanently fastened at the bottom of the vessel. The vertical shaft is mounted on the thrust bearing at one end and bearing acts like simply supported bearing supports other end. The blades of unequal size are fastened on the collar with the help of screws and the collar is mounted on the shaft at equal pitch with the help of screws. This type of provision has been provided for removing the blades for hardening purpose and also for changing the pitch of the blades. Three of the bottom blades are bend at 90 from the edge for certain length according to the domestic mixer. At the bottom of the shaft pulley is fixed. The motion is transferred from the A.C. motor to the shaft with the help

of V belt pulley drive system. The two pulleys are 3 inch and 5 inch in diameter therefore the shaft rotates at highest speed i.e. 1700 rpm at the bottom of the vessel a cover has been provided and at bottom of the vessel door has been provided to remove the material.

WORKING

Initially the motor is switched on and the motion is transferred to the shaft which rotates at higher speed. The blades also rotate. Now the waste material like sugarcane leaves, corn husks, ground nut husks etc., are fed from the top of the vessel.as the material passes in to the vessel. The material gets cuts into small pieces. Wait for some minutes to cut properly to the required size. Stop the machine, open the bottom door and remove the material.

7.2 MIXTURE UNIT

INTRODUCTION

In machine the material which is cut in cutting unit into small size is fed in to the mixture unit and added with the binder and properly mixing is done to obtained homogeneous mixture and transfer to the block maker.

CONSTRUCTION

The structure of the machine is constructed using angles. The drum of mixer is made from C.R. sheet is rest on structure. The base plate is fastened at the bottom of the drum with the help of welding. The thrust bearing is mounted at the Centre of the base plate. The vertical shaft is simply supported on the bearings. At the top of the shaft V a pulley is mounted. The motion is transferred from motor to pulley with the help of belt. The pulleys are of equal sizes so there is a speed reduction to the shaft. The stirrer is permanently welded to the shaft along its length.

WORKING

The material which is cut in cutting unit is transferred to the mixture unit. The binder i.e. cow dunk is also added in the required quantity in the material. Then switch on the motor. The power is transmitted from the motor to the shaft. The shaft also rotates and allows the stirrer to rotate for some minute to obtain homogeneous mixture. The homogeneous mixture is transferred to the block maker unit.

CHAPTER 8

DRAWINGS

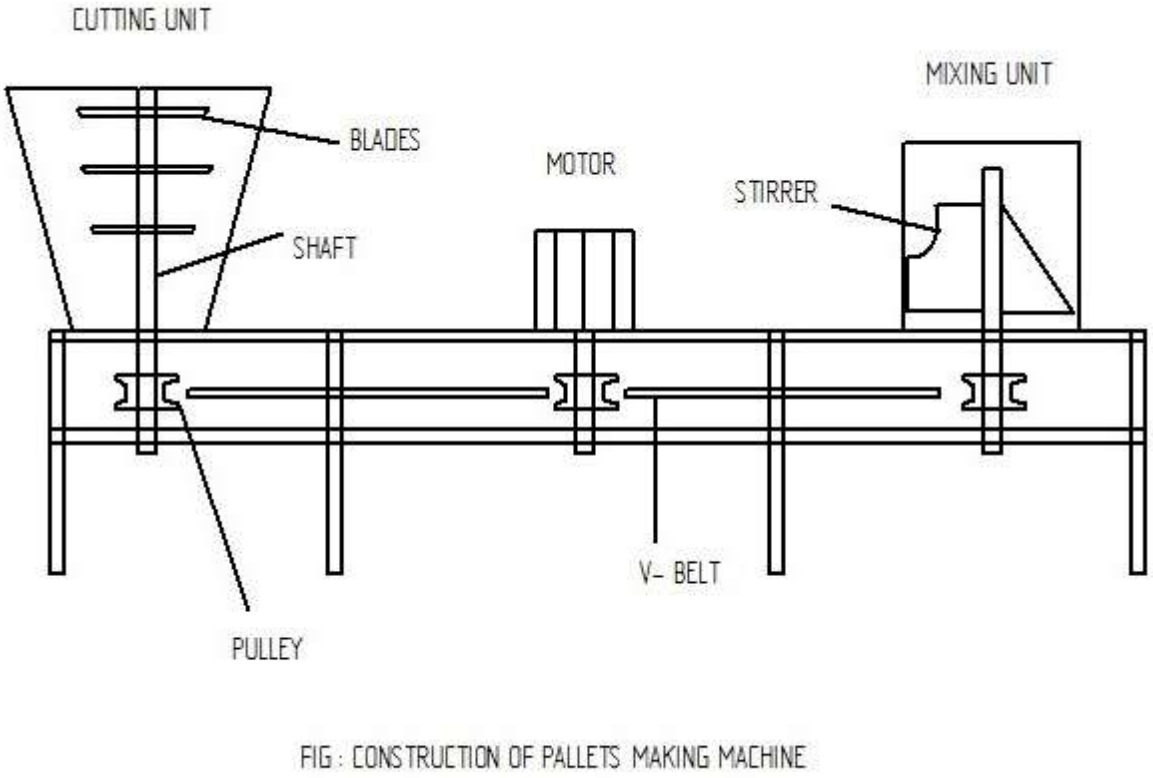
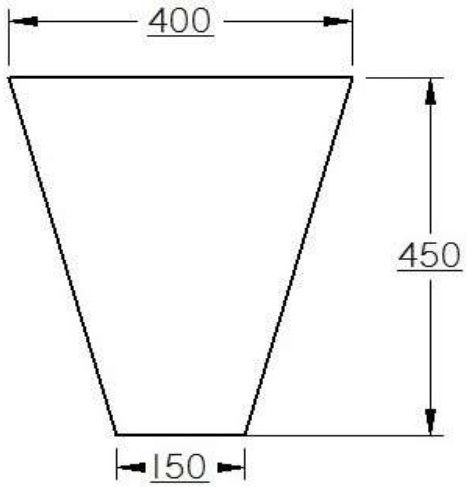
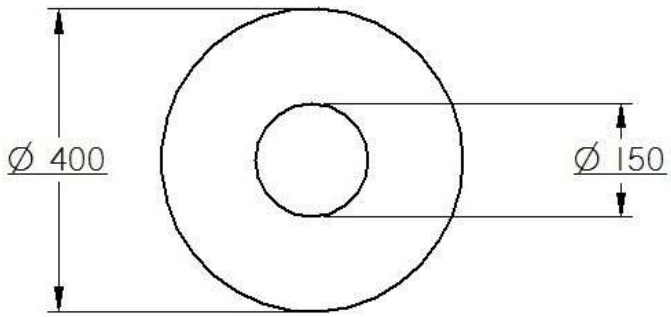


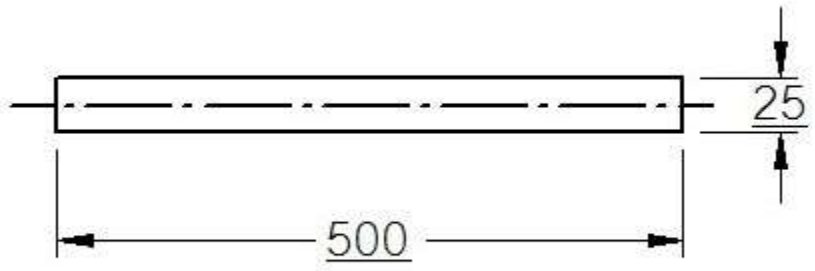
Fig. 8.1 construction of pallets making machine

1) HOPPER

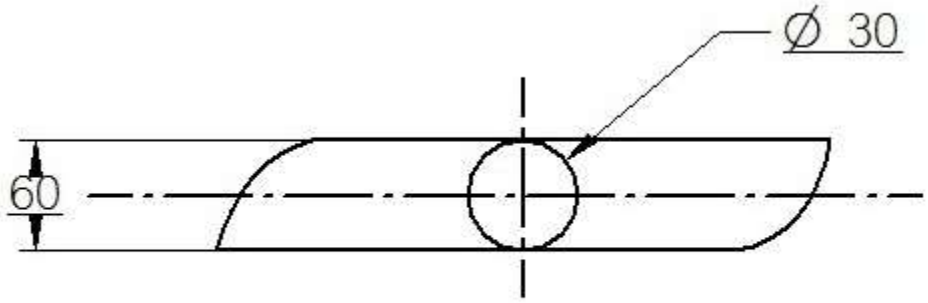




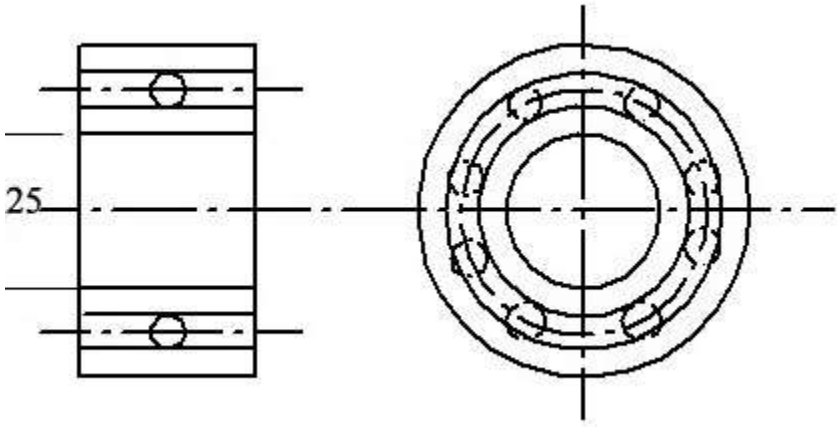
2) SHAFT



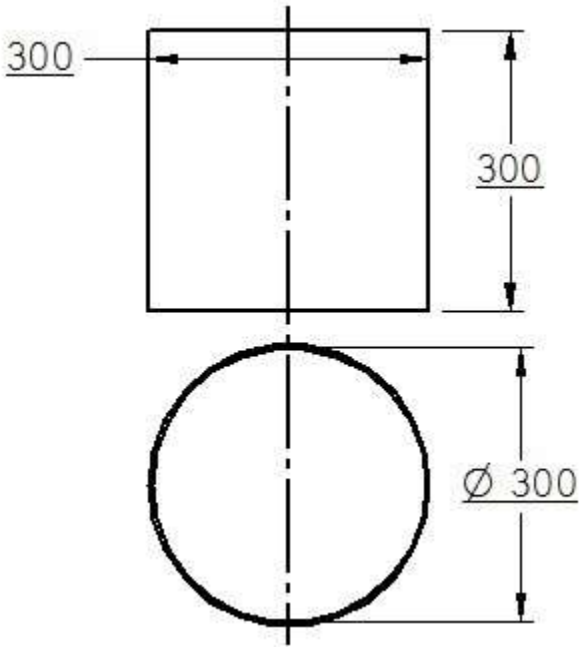
3) CUTTING BLADE



4) BEARINGS



5) MIXING UNIT VESSLE



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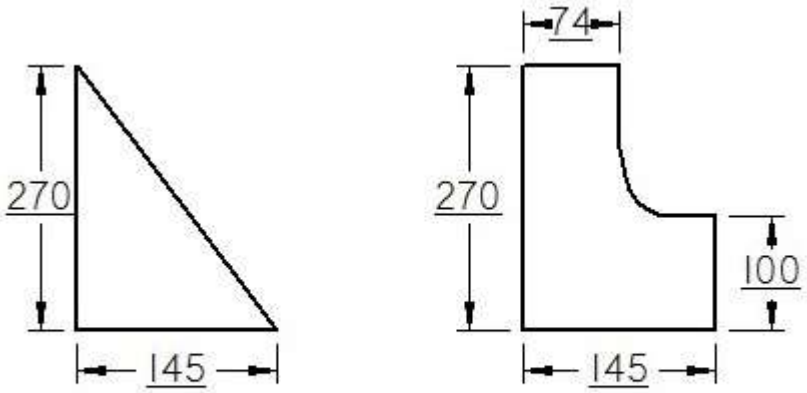
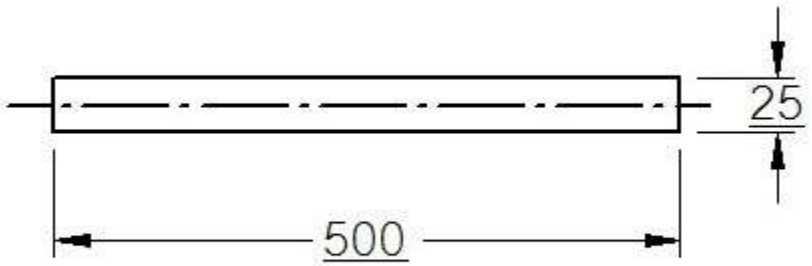
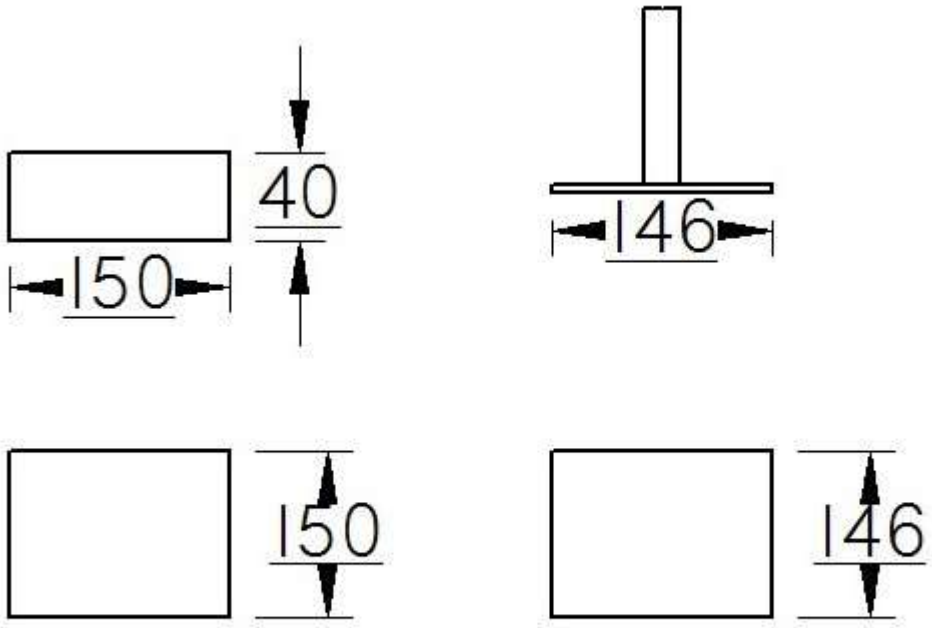
6) STIRRER BLADES



7) SHAFT



8) BLOCK MAKER



CHAPTER 9

OUTCOMES

With this idea we can make effective use of agricultural wastage, which has been neglected in practice. Our farmers burn this agricultural waste once the harvesting is done which kills the useful bacteria in soil and also causes air pollution. Our project would make use of this agriculture waste and convert them into small pallets which can be used in domestic or industry to get the heat energy. And it is a Non-conventional source of energy.

Fig. 9.1 Pallets

ADVANTAGES

1. Good substitute of coal and oil (the cost is only 10% of coal).
2. Save energy and help improve the rural environment.
3. It is renewable source of energy.
4. Row material is easily available and less expensive.
5. Effective use of agricultural waste.
6. Pallets can be made and stored and they can be used when needed.

DISADVANTAGES

1. Time required is more.
2. Working area required is more.

APPLICATIONS

1. Use for Domestic Purpose.
2. Use for Industrial Purpose.
3. Use in Jaggery Production.

CHAPTER 10

ECONOMIC ANALYSIS

Manufacturing cost of 100 gm. of block = cost of binder + cost of electricity + cost of raw material.

Cost of binder = 0.30 Rs.

Cost of electricity = 0.20 Rs

Cost of raw material = 0.0

Cost of 100 gm. of pallet = 0.50 Rs

Cost of 100 gm. of wood = 0.50 Rs.

Heat produced by 100 gm. of pallet = 313.6 KJ/KG

Heat produced by 100 gm. of wood = 259.1 KJ/KG

CHAPTER 11

EXPERIMENTAL OBSERVATION

Size of block = 150 x 150 mm

Waste material = dry leaves

Weight of block = 100 gm.

Heat produced by 100 gm. of pallet and wood

This experiment is done by heating the 1kg of water.

1) For 100 gm. of pallet:

Heat produced = m x Cp x (temp. difference)

= 1 x 4.18 x 75

= 313.5 KJ/KG

2) For 100 gm. of wood:

Heat produced = m x Cp x (temp. difference)

= 1 x 4.18 x 62

= 259.16 KJ/KG

CHAPTER 12

COST ESTIMATION

COMPONENTS	QTY.	RATE PER KG / PIECE (RS.)	TOTAL COST (RS.)
M.S. plate	25 Kg	70	1750
Angles of	20 Kg	70	1400
M.S. Rod	5 ft.	200	1000
Motor	1 hp.		5000
Ball bearing	4	325	1500
v-belt	2	250	500
Coller material	2	150	300
Pulleys	3	350	1050
Nut & bolt	10		500
packing's	3		300
Paint			500
Machining			3000
Fabrication			4500
		TOTAL COST	20300.00

CONCLUSIONS

With this idea we can make effective use of agricultural wastage, which has been neglected in practice. Our farmers burn this agricultural waste once the harvesting is done which kills the useful bacteria in soil and also causes air pollution. Our project would make use of this agriculture waste and convert them into small pallets which can be used in domestic or industry to get the heat energy. And it is a Non-conventional source of energy.

From the test results it is also concluded that further investigation is needed to improve on the other properties (beside calorific value) of the manufactured briquettes.

SCOPE FOR FUTURE WORK

- For faster process and reliable use of machine the pallets making process can be automated.
- Optimize the composition of pallets to get the maximum calorific value.

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