ISSN 2395-1621

Design and Automation of Bunding Machine

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ABSTRACT

Due to the manual method of Bed Making in Agricultural land farmers faced many problems. Such as unequal formation of a Beds leads to improper crop cultivation, Also more Manpower is needed for bed making and economically it is not suitable and time required is more in conventional Bed Making system.There is one system which is manually operated for making of beds called bunding machine it is operated by man power. Due to the manual operation need of distance verification is not achieved also man power required is more So there is need of automatic system which can verify distance according to the need of farmer also it can reduce the human effort. For automation of the bunding machine we were gone through various options such as cam and follower, sensors, timers, hydraulic system. After all study we concluded that the hydraulic system is more suitable for our machine. The advantages of hydraulic systems over other methods of power transmission are simpler design, flexibility, smoothness, control operation, low cost & it has overload protection.

ARTICLE INFO

Article History

Received :29th February 2016

Received in revised form :

1st March 2016

Accepted : 4th March 2016

Published online :

6th March 2016

I. INTRODUCTION

1.1 Problem Statement

"Design, Analysis and Automation of Bunding Machine"

1.2 Objectives

The main objective of this project is accuracy in agricultural lands so as to improve productivity of lands. Also we are going to do the automation in that machine so man power will saved so an system with minimum effort we are going to design.

1.3 Scope and Methodology

This machine is used for making Bed in agricultural land. Generally farmers are using manual method for making of beds in land. With the help of shovels (Favade) farmer spud the land and make the beds of suitable size.

Due to this manual method of Bed Making in Agricultural land farmers faced many problems. They are as follows[1],

- Unequal formation of a Beds leads to improper crop cultivation.
- Also more Manpower is needed for bed making and economically it is not suitable.
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- Time required is more in conventional Bed Making system.

For our problem statement we were thinking for various solutions such as

1. Use of cam and follower for distance verification but load is heavy so small cam can't sustain that much load and use of bigger cam leads to bulky model. So it required more pulling power and it is not suitable for Tractor.
2. Use of timers and sensors leads to maintenance problems. Also we can't use timers on rough and uneven surface. In land we required rigid model which can sustain the heavy loads as well as it should be suitable for environmental conditions. If we want to use this machine in muddy place then sensors will not operate properly. So there is need of system which can sustain all this conditions.
3. So we decided to use hydraulic system. Hydraulic system has so many advantages such as low cost, simpler design also it has overload protection.

1.4 Hydraulic System for power transmission

The advantages of hydraulic systems over other methods of power transmission are-

- **Simpler design**: In most cases, a few pre-engineered components will replace complicated mechanical linkages.
- **Flexibility**: Hydraulic components can be located with considerable flexibility. Pipes and hoses instead of mechanical elements virtually eliminate location problems.
- **Smoothness**: Hydraulic systems are smooth and quiet in operation. Vibration is kept to a minimum.
- **Control**: Control of a wide range of speed and forces is easily possible.
- **Cost**: High efficiency with minimum friction loss keeps the cost of a power transmission at a minimum.
- **Overload protection**: Automatic valves guard the system against a breakdown from overloading.

The main disadvantage of a hydraulic system is maintaining the precision parts when they are exposed to bad climates and dirty atmospheres. Protection against rust, corrosion, dirt, oil deterioration, and other adverse environmental conditions is very important

Expenditure:

Here we need following components

1. Hydraulic cylinder
2. MS Fabricated parts
3. Bearings

So our approximate overall cost for this system is Rs 10,000.

2.FABRICATED PARTS

Machining processes used for fabrication are as follows-

- Cutting
- Pressing
- Welding

2.1 MATERIAL & METHOD USED FOR FABRICATED PARTS ARE-

2.1.1 Mild steel bars

Material- C50
Tensile strength- 700 N/mm2
Yield strength- 460 N/mm2
Density- 7850 kg/m3
Young’s Modulus- 210 GPa

Properties

Mild steel is low carbon steel and mainly used where large quantity of steel is required. MS contain 0.05-0.25% carbon making it malleable and ductile. It has relatively low tensile strength, but it is cheap and easy to form so we used for making our fabricated parts.

2.1.2 Decision Criteria for selecting suitable method:

So how do you make the best decision on which process to use?

1. Start with Thickness:
   [1]. Thinner than 0.080” use laser.
   [2]. Thinner than 0.125 use plasma or laser.
   [3]. Thinner than 0.250 use waterjet, plasma, or laser.
   [4]. Over 8” use oxy-fuel.
   [5]. Over 2” use oxy-fuel or waterjet.
   [6]. Over 1.25” use plasma, oxy-fuel, or waterjet.
2. Consider the Accuracy and Edge Quality requirement:
   [7]. Can you accept the edge quality of plasma? Most fabrications from steel plate can be welded just fine using a plasma cut.
   [8]. Can you accept the Heat Affect Zone of oxy-fuel, plasma, or laser? If not, use waterjet.
3. Consider which is more important: Productivity or Cost?
   [9]. If production rate is most important, steer clear of waterjet.
   [10]. If low initial investment and low operating cost are most important, look to oxy-fuel.

2.1.3 Cutting:

There are many ways to cut mild steel plate, some of which are suited for automation some are not. Some are suited for thinner plate, some for thicker. Some are fast, some are slow. Some are low-cost, some expensive. And some are accurate, some are not. This article takes a quick look at the four primary methods used on CNC shape cutting machines, compares each processes strengths and weaknesses, and then gives a few criteria that can be used to decide which process is best for your application.

Oxy-Fuel Cutting :

Oxy-fuel torch cutting, or flame cutting, is by far the oldest cutting process that can be used on mild steel. It is generally viewed as a simple process, and the equipment and consumables are relatively inexpensive. An oxy-fuel torch can cut through very thick plate, limited primarily by the amount of oxygen that can be delivered. It is not unheard of to cut through 36, or even 48 inches of steel using an oxy-fuel torch. However, when it comes to shape cutting from steel plate, the vast majority of work is done on 12 inch thick plate and thinner.

When adjusted properly, an oxy-fuel torch delivers a smooth, square cut surface. There is little slag on the bottom edge, and the top edge is only slightly rounded from the preheat flames. This surface is ideally suited for many applications without further treatment.

Oxy-fuel cutting is ideal for plates thicker than 1 inch, but can be used all the way down to about 1/4 inch thick plate, with some difficulty. It is a relatively slow process, topping out around 20 inches per minute on 1 inch material. Another great thing about oxy-fuel cutting is that you can easily cut with multiple torches at once, multiplying your productivity.

By considering all the factors such as cost, availability and working environment we have used gas welding. The flame we use consist of LPG gas and Oxygen. Which create maximum temperature upto 2400 degree.

2.2 WELDING

MIG (Metal Inert Gas) welding, also known as MAG (Metal Active Gas) and in the USA as GMAW (Gas Metal Arc Welding), is a welding process that is now widely used for welding a variety of materials, ferrous and non ferrous. The essential feature of the process is the small diameter electrode wire, which is fed continuously into the arc from a coil. As a result this process can produce quick and neat welds over a wide range of joints.

2.2.1 Equipment

_ DC output power source
_ Wire feed unit
_ Torch
_ Work return welding lead
_ Shielding gas supply, (normally from cylinder)

Power Source

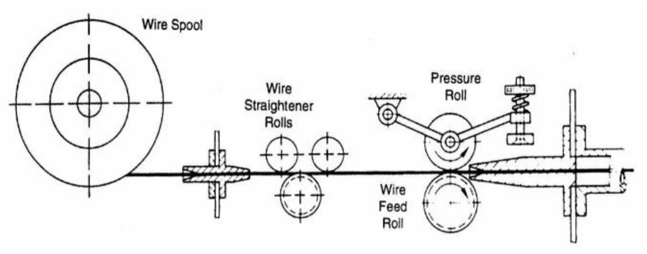
MIG welding is carried out on DC electrode (welding wire) positive polarity(DCEP). However DCEN is used (for higher burn off rate) with certain self shielding and gas shield cored wires. DC output power sources are of a transformer-rectifier design, with a flat characteristic (constant voltage power source). The most common type of power source used for this process is the switched primary transformer rectifier with constant voltage characteristics frm both 3-phase 415V and 1-phase 240V input supplies. The output of direct current after full wave rectification from a 3-phase machine is very smooth. To obtain smooth output after full wave rectification with a 1- phase machine, a large capacitor bank across the output is required. Because of the expense of this, many low cost 1-phase machines omit this component and therefore provide a poorer weld characteristic. The switches to the main transformer primary winding provide the output voltage steps at the power source output terminals.

A thermostat is fitted on the hottest point in the power source, in series with the contactor coil to provide thermal protection to the machine. Power source performance is measured by it's ability to provide a certain current for a percentage of a 10 minute period before "Thermal Cut-Out". This is the "Duty Cycle".

The Wire-feed Unit

The wire-feed unit, or sub-assembly where this is mounted in the power source cabinet (known as a composite MIG), provides the controlled supply of welding wire to the point to be welded. According to the welding wire size and

Arc voltage provided by the power source, a constant rate of wire speed is required, in MIG welding the power source provides Arc voltage control and the wire feed unit provides welding wire speed control, (in MIG this equates to welding current).Most modern wire feed units control the wirefeed speed via a DC motor and thyristor control PCB to provide continuos control of Armature volts and hence RPM of motor. The wire feed motor spindle has a feed roller fitted and another pressure roll, adjustable spring mounted to lightly grip the wire and push it up the length of the MIG torch.



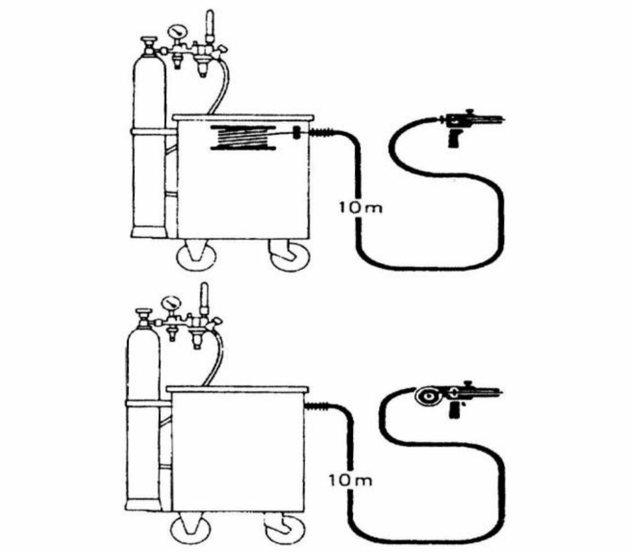
Schematic illustration of a wire feeder with two roll.

Fig 1-Schematic illustration of a wire feeder with two roll

The MIG Torch

This provides the method of delivery from the wire feed unit to the point at which welding is required.The MIG torch can be air cooled or water cooled and most modern air cooled torches have a single cable in which the welding wire slides through a Liner. Gas flows around the outside of this Liner and around the tube the Liner sits in is the power braid and trigger wires. The outer insulation provides a flexible cover. Water cooled MIG torches are similar to the above, but gas hose, liner tube, power lead (including water return pipe), water flow pipe and trigger wires are all separate in an outer sleeve.

Most industrial MIG equipment uses a standard European MIG torch connector for easy connection of torch, some low cost smaller units use individual manufacturers fittings.The important areas of maintenance are: Liners are in good condition and correct type and size; Contact tips are lightly fitted, of correct size and good condition.



Different combinations of wire feed units and welding guns (for soft wires).

Fig 2-Different combinations of wire feed units and welding guns

Shielding Gas

This is a complicated area with many various mixtures available, but the primary purpose of the shielding gas in the MIG process is to protect the molten weld metal and heat affected zone from oxidation and other contamination by the atmosphere. The shielding gas should also have a pronounced effect on the following aspects of the welding operation and the resultant weld.

Arc Characteristics A basic position or starting point would be

• Mode of Metal Transfer
• Penetration and Weld Head Profile Aluminium - Argon
• Speed of Welding Magnesium - Helium
• Undercutting Tendency Copper Alloys - Argon - Helium Mix
• Cleaning Action Steel - CO2 not commonly used

Weld Metal Mechanical Properties today, Ar-CO2 mix is Preferred .

3.1 DESIGN OF A HYDRAULIC CYLINDER

We are working with the Bhansali's team so we found that load exerted by land on machine which is to be overcome by using hydraulic cylinder is 0.75 ton. So we have design the hydraulic cylinder which can sustain the load of 750kg.

For design we select model 'A5'

Bore diameter (dp) = 100mm= 0.1m

Rod diameter (dr) = 50mm= 0.05m

(Pressure)× (Area of Piston) = (Force)

$P \times \pi/4 \times dp^2 = 11.232\times10^5$ N/m2

$P = 14.301 \times 10^5$ N/m2

Stroke(s) = 0.5m

Time (t) = 10 sec

Vret = s/t

Q= Ap× Vret

$= \pi/4\times dp^2\times$ Vret

$= \pi/4\times (0.1)^2\times 0.05$

$= 3.9266\times10^{-4}$ m3/s

=23.5619 lpm

Power= (pressure)×(flow rate)

= P×Q

$= 14.301\times10^5\times23.5619/60\times10^{-3}$

= 561.5526 Watt

Various Components used are

1. Reservoir Tank- Tractor
2. Pump- Tractor
3. Strainer- Tractor
4. Relief Valve-

Selecting model for values Q= 23.5619 lpm, P=14.301 bar

Model 'R3'

Capacity =30.4 lpm , pressure=70 bar

5. Direction Control Valve (DCV)= 413 DCV Solenoid operated

We select Model 'D2'

Capacity (Q)= 38 lpm, P=210 bar

1. Check valve

Model 'C2'

Flow capacity 30.4 lpm

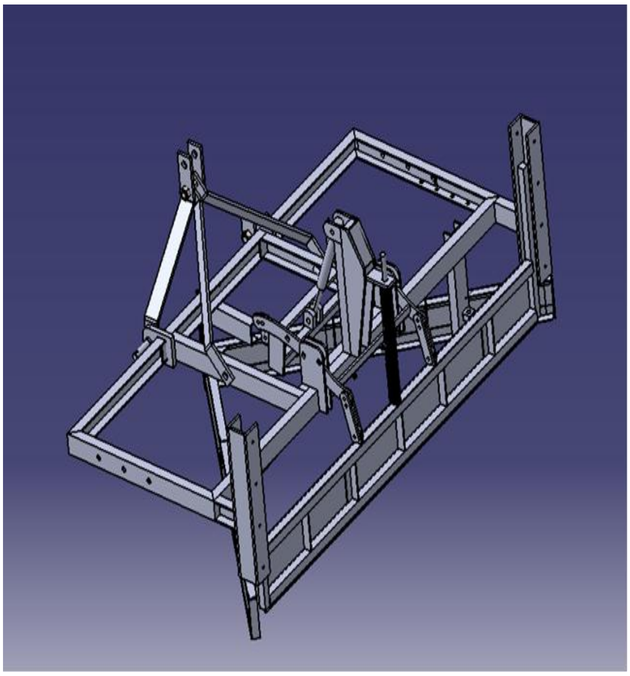


Fig 3-Bunding Machine model with hydraulic cylinder

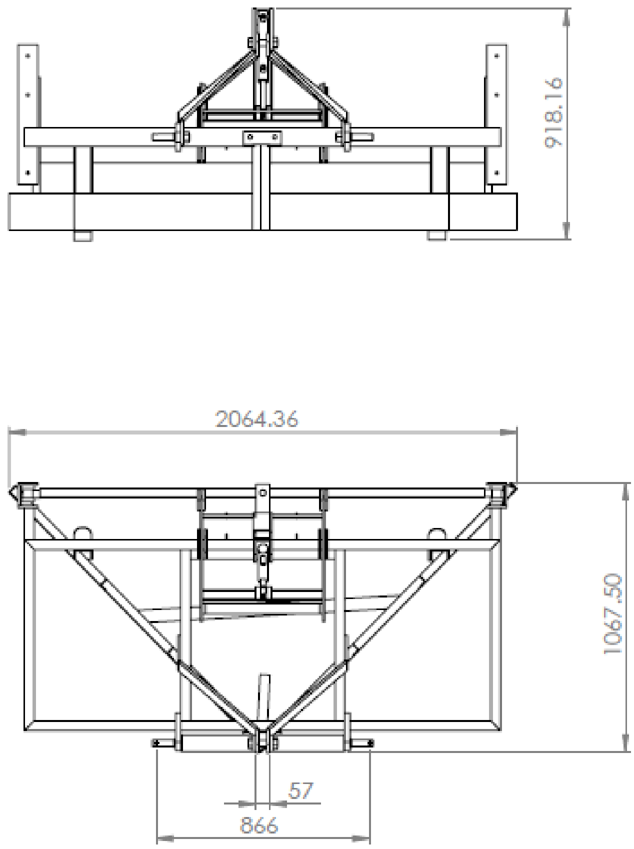


Fig 4-Assembly Design Of Bunding Machine

ACKNOWLEDGEMENT

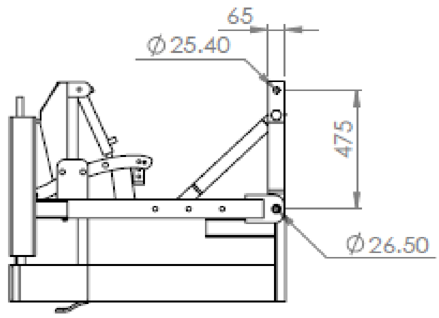
I feel great pleasure to present the project entitled "Design, Analysis and Automation of Bunding Machine". But it would be unfair on our part if we do not acknowledge efforts of some of the people without the support of whom, this project would not have been a success.

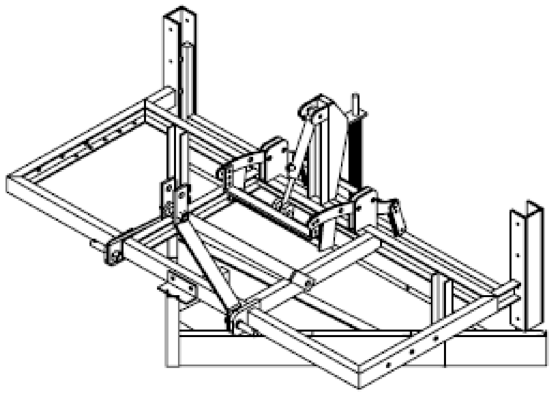
First and foremost, we are very much thankful to our respected project guide Prof. V. J. Suryawanshi for his leading guidance and sincere efforts in selecting and finalizing this project topic. He took deep interest in correcting the minute problems and guided us through whole project. Also he has been a persistent source of inspiration to us. Also we would like to thank Mr. Pawan Choudhari, Design Engg at Bhansali's Organization. He shares his fruitful knowledge and experience with us.

We would like to give sincere thanks towards Dr. A. G. Thakur, vice principal and Head of Department, Mechanical Engineering, S.R.E.S. College of Engineering, Kopargaon, for giving me opportunity to present this seminar report.

Also we would like to thank our project in charge Prof. P. M. Patare.

Most importantly we would like to express our sincere gratitude towards our Families for always being there when we needed them most. And last but not a least special thanks to our all friends for their presence and encouragement throughout the project work.





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