

Design And Manufacturing Of Agriculture Equipment-Hydraulic Plough

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ABSTRACT

Presently, small land holding farmers use work bulls mostly for land preparation. but now in 21 century the world is in developed manner, everyone has new idea and technique so to go with smart work. This project is focused on the “design and Manufacturing Agriculture equipment-Hydraulic Plough” Hydraulic Reversible Plough is specially designed for variety of uses in agriculture for medium, hard and black cotton soil. It is a simple and reliable machine. Also versatile and compact. It can be coupled with all tractors form 23hp to 55HP. produces a fine seed bed with one or two operation before or after rains. it is most suitable for removal of sugarcane stubble, wheat stubble, caster, grass, vegetables etc. It retains soil moisture and increases soil porosity and aeration, which enhance germination and growth of crops. It can be used in dry and wet paddy condition for puddling. It tilts soil finely, incorporating every kind of crop residues into the soil and improves the organic structure of soil. Specially designed Blade plow reduces load on tractor and avoids tyre slippage and reduces diesel consumption. At the end of each row, the paired ploughs are turned over, so the other can be used. This returns along the next furrow, again working the field in a consistent direction. Hydraulic reversible Plough is used to turn over the upper layer of the soil, bringing fresh nutrients to the surface, while burying weeds, the remains of previous crops, and both crop and weed seeds, allowing them to break down. The Hydraulic plough is very simple to use, the various adjustments are made with ease, and it is low in maintenance

INTRODUCTION

Agriculture has been the backbone of the Indian economy and it will continue to remain so for a long time. A man without food for three days will quarrel, for a week will fight and for a month or so will die. Agriculture is a branch of applied science. Agriculture is the science and art of farming including cultivating the soil, producing crops and raising livestock. It is the most important enterprise in the world.

The turnover of the reversible plough is done by a Hydraulic cylinder; which reduces the fatigue to tractor driver considerably. Due to smooth turnover, no impact vibrations are experienced. Hence long life to plough & tractors is achieved.

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Problem Statement:

Hydraulic Reversible Plough is specially designed for variety of uses in agriculture for medium, hard and black cotton soil. It is a simple and reliable machine. Also versatile and compact. It can be coupled with all tractors from 23hp to 55HP. Reversible plough The reversible plough has two moldboard ploughs mounted back-to-back, one turning to the right, the other to the left. While one is working the land, the other is carried upside-down in the air.

Objectives of the project:

- used to turn and break up soil, to bury crop residues, and to help control weeds.
- Study the properties of this design and compare it on the bases of cost, efficiency and environmental impact.
- Shear Bolt Safety Protection, Centre Adjustment Setting, Working Width Adjustment, Underbody and Interbody clearance such functions are available
- To record and analysis the characteristics of this plough with respect to power and efficiency.

Methodology:

- Literature survey on agriculture equipment design and manufacturing of hydraulic plough
- Finalization on topic, problem statement, objective and scope definition
- Design and selection of parameters
- Development of model
- Experimentation and testing
- Validation of result and future scope

Scope:

- used to turn and break up soil, to bury crop residues, and to help control weeds.
- Time saving equipment and easy to handle
- The scope of this project to go with smart work using reversible hydraulic plough
- To maximize the efficiency of hydraulic plough for low head conditions.

Literature Review

KC Mouli, S Arunkumar, B Satwik, SB Ram... - Materials Today ..., 2018 – Elsevier:

In farming operations, tillage is the primary and energy consuming operation. The purpose of the tilling the soil is to provide favorable soil conditions by cutting and inverting the soil for seeding or transplanting. Advanced tillage equipments are available in the market. However, poor farmers and the one with small farm size cannot afford them, as they are costly to buy and maintain. This paper briefly reviews the different types of plows used for preparing the land. Three types of simple reversible plow attachments have been designed. The materials and manufacturing processes to prepare these plow attachments is also discussed. The tractive and the thrust forces for these plow attachments are then estimated analytically.

Design and test of automatic leveling system of plough rotary machine. 2018 Vol.34 No.17 pp.25-31 ref.31:

n order to solve the problem of equipment adjusting in the operation of plough rotary tiller, an

automatic leveling system of plough rotary machine is designed, which includes executive mechanism, automatic leveling control module, hydraulic system and tilt sensing module. The plough rotary machine is a kind of well-behaved machine on tillage and straw returning, which combines the function of plough turning and rotary tillage. It can be used to carry out multiple work processes such as plough turning, rotary tillage and burying ground straw into soil. The soil is finely ground after ploughing, and the crop stalks and stubble are directly buried in the fields to achieve the soil preparation effect. It can also reduce the number of operations of going into soil for the machine, reduce the compaction of the soil, and improve the efficiency of farming. In the process of work, one side of tractor wheel drives on the balk, the other side drives on the cultivated furrows, causing tractor to incline to walk, and then leading to a certain inclination in horizontal direction of the plough rotary machine connected with the tractor through the three-point suspension mechanism. However, the tilting of plough rotary machine will affect the flatness and depth of the plow, so it is necessary to continuously adjust the equipment to ensure the work effect. Due to the complexity of field work condition, it needs to adjust frequently on the first 2 work routes and every route caused by the unstable work of the hydraulic system in each field. It not only is time-consuming but also has not high precision, which results in poor performance and low efficiency of work. In order to solve the problem of frequent adjustment of the plough rotary machine during work of plough, combining the characteristics of the plough rotary machine, a method to determine the angle range of leveling is put forward. The plough rotary machine as a compound tillage machine has great quality. It will cause great burden to the hydraulic system of the tractor by automatic leveling. At the same time, the downward motion will appear more severe during the downgrading process of the plough rotary mechanism. Therefore, a set of independent hydraulic system is designed in this paper. According to the actual field work situation, the soil model is established by using EDEM (enhanced discrete element method) simulation software, and the virtual simulation of field operation is carried out. The simulation results show that the surface roughness is less than 2 cm and meets the agronomic requirements. On the basis of design and simulation, field experiments were carried out to compare the operation of manual leveling plough rotary machine and the operation of automatic leveling plough rotary machine. The content of the test includes the system performance and mechanical performance of automatic leveling. The system performance is obtained by analyzing the change of the inclination angle of the tractor. The mechanical performance is obtained by analyzing ploughing depth, its stability and surface roughness after the operation. The results show that the automatic leveling plough rotary machine has a marked improvement in the stability of ploughing and surface evenness after tillage compared with the manual leveling plough rotary machine. The stability coefficient of the former tillage depth is 87.31% and the latter is 84.76%. The surface roughness of the former is 1.97 cm and the latter is 2.56 cm. It can provide reference for the design of automatic leveling system for compound agricultural machinery.

Method and System of Plowing Depth Online Sensing for Reversible Plough Volume 51, Issue 17, 2018:

The reversible plough is a quite useful farm machinery for deep tillage, which is directly mounted to the tractor. It works on both the left and right side with bilateral turnover mechanism and automatically reverses the position. According to its structure characteristic, based on deviation correction method, a depth online sensing model was proposed firstly by integrated attitude data from tractor and reversible plough. In this model, plowing depth was obtained by calculate the pitch attitude of the lower link which suspended at the back part of a tractor and reversible plough. Then, on the basis of this model, developed ARM embedded microprocessor based plowing depth detection sensors and deep plough online sensing system. This system which integrated the Global Positioning System(GPS), the General Packet Radio Service (GPRS) and SD Card, was designed for real-time collecting the operation information from tractor and reversible plough, such as deep plough, position, velocity and heading. In the meanwhile, all the collected information stored in terminal device of this system and simultaneously transmitted to remote data center for further fusion data processing and comprehensive evaluation of operation quality. This calibration tests result conformed that the system calibration absolute error was -3.61mm, which indicated the system had high accuracy in static condition.

Ploughing Test and Analysis of High Speed Flip Plough 2020 2nd International Conference on Artificial Intelligence and Advanced Manufacture (AIAM) 15-17 Oct. 2020 :

In order to reduce the working energy consumption and improve the working efficiency, this paper studies the effects of soil moisture content, soil compactness and soil adhesion on ploughing

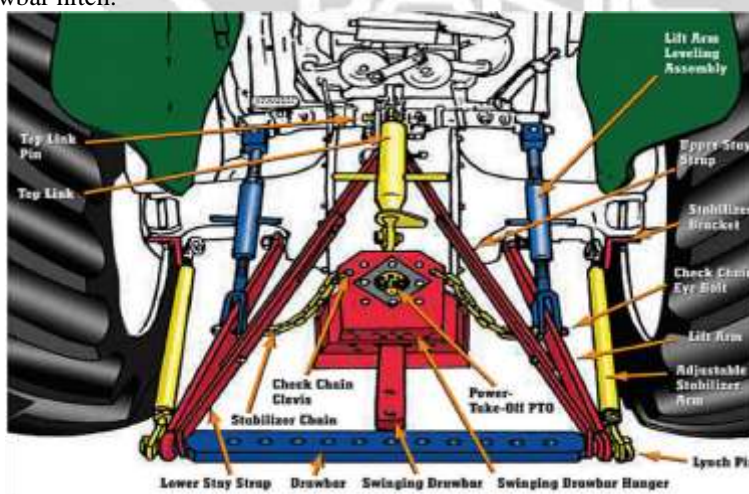
resistance. After field experiments, the effects of single factors on ploughing resistance are compared. It can be seen from the experiments that the surface compaction is higher than that of the bottom layer, With the increase of soil surface compactness, the ploughing resistance increases, and with the increase of adhesion, the ploughing resistance increases. According to the orthogonal experiment of three factors and three levels, the results show that moisture content is 17.48 % and soil compactness is 230.82 N/cm² and the ploughing resistance is minimum when the adhesion force is 1.9 N. This study provides a theoretical reference for reducing energy consumption and improving efficiency in high-speed turnover plow operation.

Taking into consideration the current trend to mitigate the agriculture's negative impact on the environment, this implies using new technologies and equipment for performing agricultural works. Currently, the most used equipment in agriculture is the agricultural tractor with heat engine. One alternative is represented by electric motors, usually powered by batteries. The main advantage for the environment is that zero emissions are released into the atmosphere during agricultural works. Another advantage consists of the nominal torque which could be sustained from almost zero revolutions of the electric motors resulting in lower loads on the batteries with a proper mechanical transmission. Ploughing represents the agricultural work which exploits most of the performances of an agricultural tractor, in terms of fuel consumption and engine wear. Within this paper are presented the tests performed on an electric tractor during ploughing works, at different depths and with different working speeds, in order to assess its autonomy and efficiency with a single battery charge. The electrical parameters of the tractor were recorded during tests, as well as the tractor draft force. The results were used to establish the optimal working regime of the electric tractor during ploughing works.

Construction

Components of design and manufacturing agriculture equipment-hydraulic plough is given below:

- 1) Drawbar hitch:



drawbar is a solid coupling between a hauling vehicle and its hauled load. Drawbars are in common use with rail transport, road trailers, both large and small, industrial and recreational, and with agricultural equipment. Each hitch has attachment holes for attaching implements, and the implement has posts that fit through the holes. The

implement is secured by placing a pin on the ends of the posts.

2) Drawbar Hitch pin:

is a device attached to the chassis of a vehicle for towing, or a towbar to an aircraft nose gear. It can take the form of a tow ball to allow swiveling and articulation of a trailer, or a tow pin, or a tow hook with a trailer loop, often used for large or agricultural vehicles where slack in the pivot pin allows similar movements. Another category is the towing pintle used on military vehicles worldwide. To tow safely, the correct combination of vehicle and trailer must be combined with correct loading horizontally and vertically on the tow ball. Advice should be taken (see references) to avoid problems.



3) Hydraulic pump:



A hydraulic pump is a mechanical device that converts mechanical power into hydraulic energy. It generates flow with enough power to overcome pressure induced by the load. Secondly, its mechanical action delivers this liquid to the pump outlet and forces it into the hydraulic system

4) Main shaft:

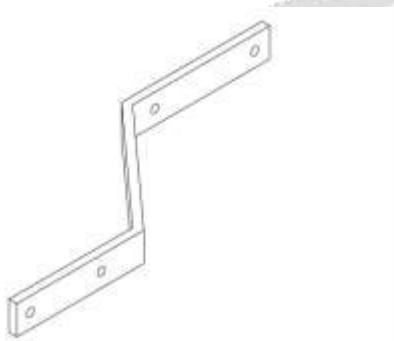
The line of shafting that receives its power directly from the engine or motor and transmits power to other parts.

5) Shaft housing:

Determining proper shaft and housing fits is critical to ensure long bearing life. The fit, or amount of interference that exists between mating components (such as the shaft and bearing bore), can be devised into three categories: loose (slip), transition, and press (tight).



6) Z patti:

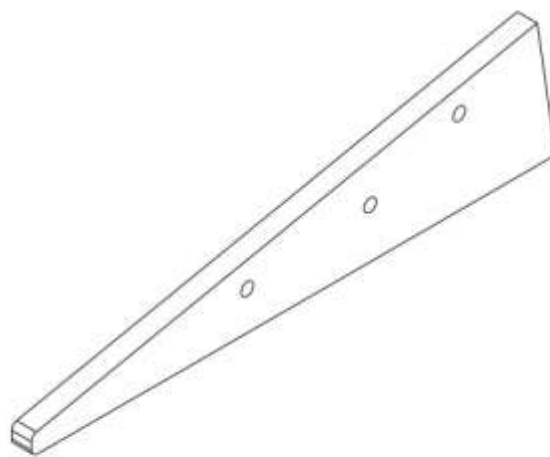


7) Frog flat:

It is the part to which share, land side and mouldboard are attached. There are three main parts i.e. mould board, landslide and share which are rigidly fastened to the frog. Its main function is to cut the furrow slice, shatter the soil and invert the furrow slice to cover trash. The size of the plow bottom is the width of furrow it is designed to cut.



8) Land side front:



Isometric view

- 9) Share bar
- 10) Share
- 11) Mould board

Working:

The reversible (or roll-over) plough has two mould-board ploughs mounted back to back, one turning right, the other left. While one works the land, the other is borne upside-down in the air. At the end of each row the paired ploughs are turned over so that the other can be used along the next furrow, again working the field in a consistent direction.

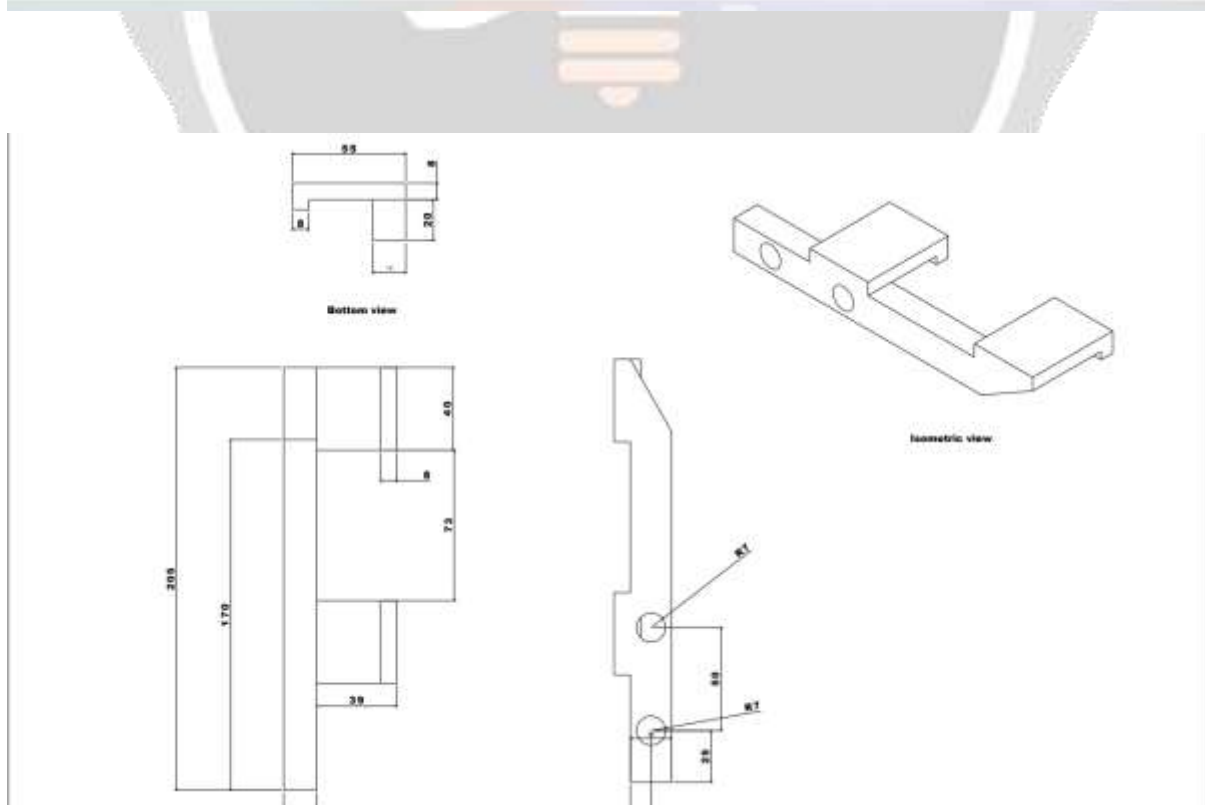
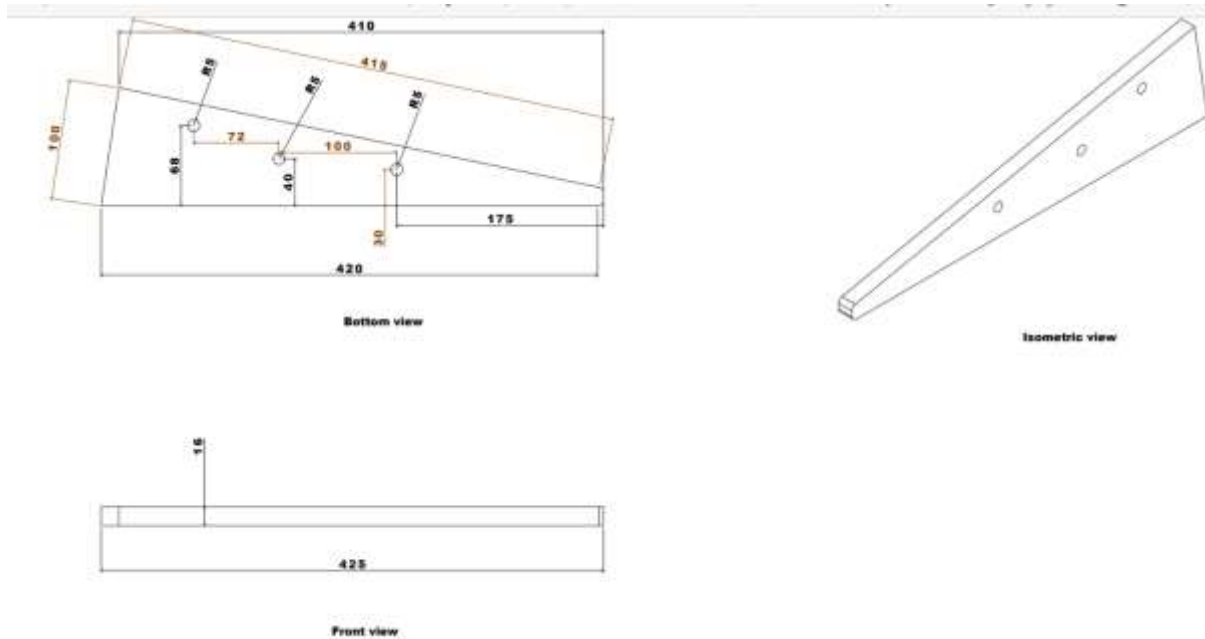
These ploughs date back to the days of the steam engine and the horse. In almost universal use on farms, they have right and left-handed mould boards, enabling them to work up and down the same furrow. Reversible ploughs may either be mounted or semi-mounted and are heavier and more expensive than right-handed models, but have the great advantage of leaving a level surface that facilitates seedbed preparation and harvesting. Very little marking out is necessary before ploughing can start; idle running on the headland is minimal compared with conventional ploughs.

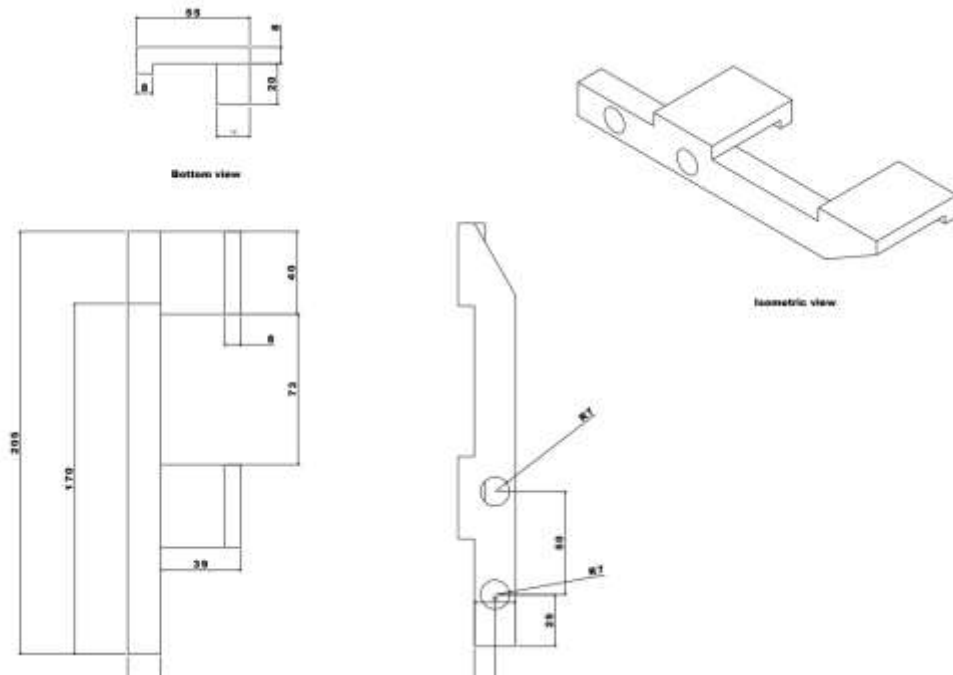
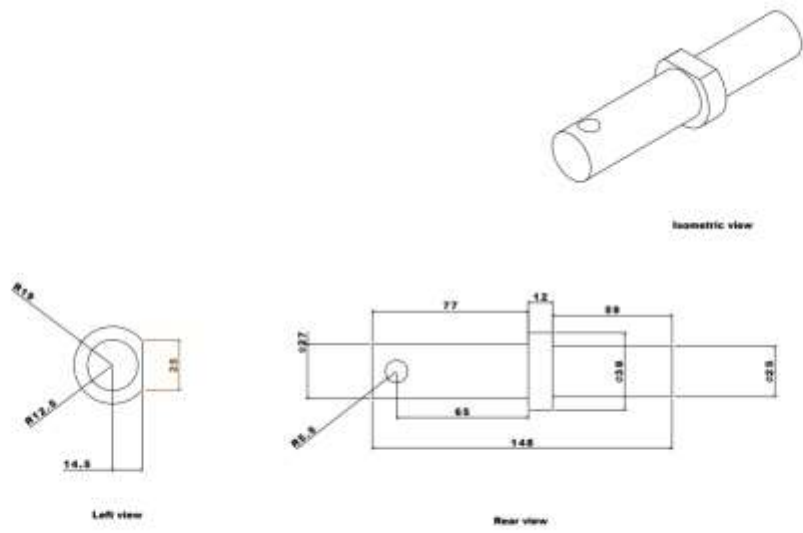
Driving a tractor with furrow-side wheels in the furrow bottom provides the most efficient line of draught between tractor and plough. It is also easier to steer the tractor; driving with the front wheel against the furrow wall will keep the front furrow at the correct width. This is less satisfactory when using a tractor with wide front tyres. Although these make better use of the tractor power, the tyres may compact some of the last furrow slice turned on the previous run. The problem is overcome by using a furrow widener or longer mould board on the rear body. The latter moves the soil further towards the ploughed land, leaving more room for the tractor wheels on the next run.

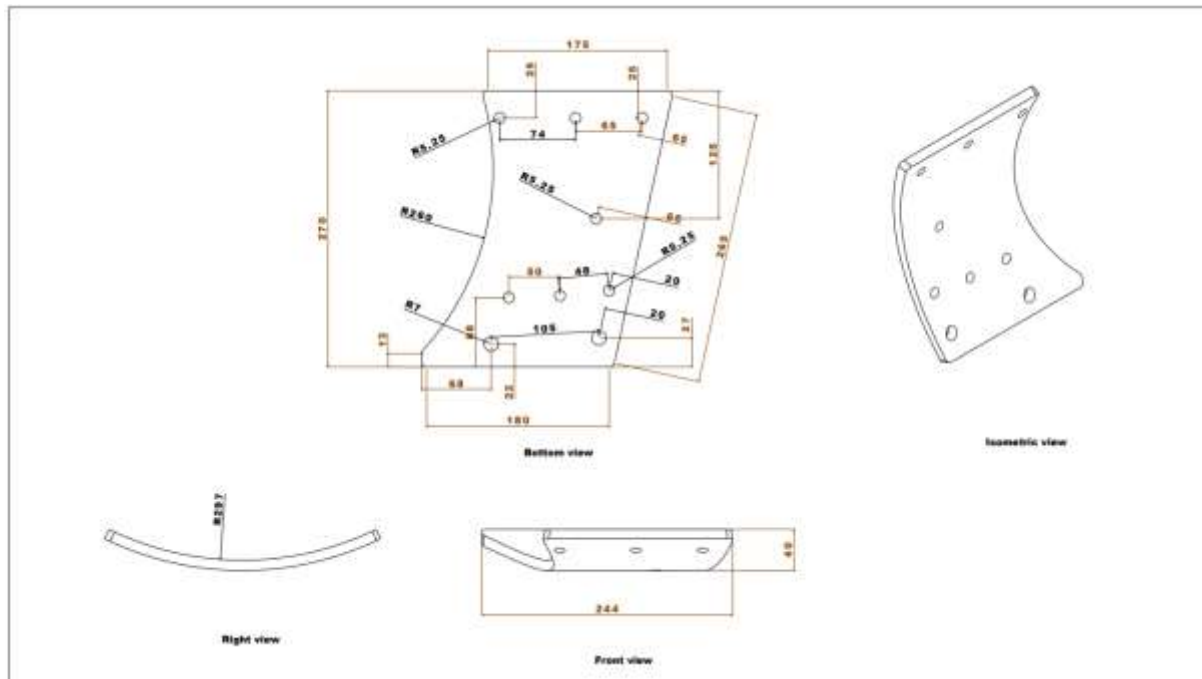
Driving with all four wheels on unploughed land is another solution to the problem of wide tyres. Semi-mounted ploughs can be hitched in a way that allows the tractor to run on unbroken land and pull the plough in correct alignment without any sideways movement (crabbing).

Analysis:

We are used the design software to manufacturing hydraulic plough and its various components:
The following all sheet are designed to be on Autocad softwares







Advantages:

- Easy to handle
- No more manpower required using hydraulic pump work will be done easily.
- Affordable cost value.
- Time saving equipment
- Smart technology

