

Fully Automatic Multipurpose Agricultural Vehicle a Major Project Report

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ABSTRACT: The Multipurpose machine is used to sowing the seeds and fertilizer spray into land and grass cutting for making lots of plant production in agricultural field. It is a mechanical device here no electrical or other power source is not required. The cost of this machine is very low and easy to operate simple in construction. As there is tremendous development in the field of engineering the current scenario makes us to find solution for major problems faced by the agricultural field. Lot of equipment was invented to sophisticate the work of labor in the farms. The main objective of this project is to improve the current way of farming by introducing multipurpose equipment. It helps farmers by grass cutting and sowing the seeds and fertilizers. We have fabricated a device called “**FULLY AUTOMATIC MULTIPURPOSE AGRICULTURAL VEHICLE**” sow the seeds first land should be cleaned and after sprayed the seeds the land should be filled. This equipment which we build will do the mentioned functions automatically. It will be very useful for agricultural purpose and very simple in construction and economical. It's mainly depending on the RF CONTROL.

I. INTRODUCTION

The very first "multi utility vehicle" was known as the Brubaker Box. This was a custom car designed in 1972 and produced in limited numbers by Curtis Brubaker, a designer and car enthusiast. It was built on the Volkswagen Beetle chassis and included an original fiberglass body. There was a sliding door on the passenger-side of the vehicle.

Agriculture is demographically the broadest economic sector and plays a significant role in the overall economy of India. For the growth of Indian economy, mechanization is necessary. The main purpose of mechanization in

agriculture is to improve the overall productivity and production. Planting is conventionally done manually which involves both animate (humans and draught animals), this result in higher cost of cultivation and delay in planting. The main purpose of this paper is to compare between conventional sowing method and new proposed machine which can perform number of simultaneous operation. The required row to row spacing, seed rate, seed to seed spacing and fertilizers placement varies from crop to crop can be achieved by the proposed machine. This machine reduces the power consumption, sowing time, human efforts and labour cost.

II. LITERATURE REVIEW

The economic contribution of agriculture in India's GDP is continuously decreasing with the country's broad-based economic growth. Still, agricultural research and development (R&D) in India has made impressive contribution in the past. But the system is under significant stress today due to lack of clarity on focus and inefficient use of financial resources. Links among sister institutions have weakened and accountability has declined over time. Ramesh D; This research paper present “Agriculture Seed Sowing Equipment: A Review”. The present review provides brief information about the various types of innovations in seed sowing equipment. The basic objective of sowing operation is to put the seed and the fertilizer in rows at desired depth and seed to seed spacing, cover the seeds with soil and provide proper compaction over the seed. Kannan A: This research paper presents design modification in multipurpose sowing machine which describes the sowing purpose and the import of the machinery, which are bulk in size having more cost. To prevent this they design multipurpose sowing machine which consists of hopper, seed metering mechanism, ground wheel, power transmission system, seed

distributor, and tiller Backpack sprayer which can be carried on the operator back, having tank capacity as large as 20 liters. A hand lever is continuously operated to maintain the pressure which makes the backpack sprayers output more uniform than that of a handheld sprayers. Basic low cost backpack sprayer will generate only low pressure and lack feature such as high-pressure pumps, pressure adjustment control (regulator) and pressure gauge found on commercial grade units. The engine operated sprayers typically produce more consistent sprayer's outputs, covers the sprays swath more uniformly, operate at constant speed and results in much more uniform coverage than the hand spraying. Motorized sprayers are also capable of higher pressure spray useful to provide a better coverage. There are many other types of hand operated sprayer that are not widely used throughout the agriculture. Some may be used extensively for the productions of specific commodities. Jeremy, in 2005 designed and fabricated solar charged cutter machine. The machine was dependent on weather since the battery would be charged using solar panel. The common drawback was that the engine runs slowly and the production cost was high for an average individual to purchase. Victor and Vern's, (2003) designed and developed a power operated rotary weedier for wet land paddy. The complex nature of the machine makes its maintenance and operation difficult for the peasant farmers.

III. COMPONENTS AND DESCRIPTION

The main components of MULTIPURPOSE AGRICULTURAL ROBOT are given below

- Wheel
- Dc motor
- Battery
- Fertilizer tank
- Motor
- Dc pump
- Blade arrangement
- Frame
- Fertilizer sprayer
- Bearings

SEED CONTAINER

This setup consists of seed container with the door arrangement which is placed over the wheel shaft. The hollow cylindrical shaped container consists of two sides enclosed by mild steel plates. The material of the seed container is made of mild steel. The middle of the container is opened to pour the seeds in it. It consists,

DIGGING PLATES

Digging plates are used to dig the land and to spray the seeds. There are four holes in the plate. It's used to mount with rod. Digging plates are made of mild steel. These plates are mounted in front of the seed container and coupled in the rod with particular distance using bolts and nuts.

By adjust the bolts and nuts we can vary the position of plates. Rod is mounted with the bearing mounting plate using bolts and nuts. It can be easily dismantled and assembled.

DC PUMP

A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps. Pumps operate by some mechanism (typically reciprocating or rotary), and consume energy to perform mechanical work by moving the fluid. Pumps operate via many energy sources, including manual operation, electricity, engines, or wind power, come in many sizes, from microscopic for use in medical applications to large industrial pumps. Mechanical pumps serve in a wide range of applications such as pumping water from wells, aquarium filtering, filtering and aeration, in the car industry for water-cooling and fuel injection, in the energy industry for pumping oil and natural gas or for operating cooling towers. In the medical industry, pumps are used for biochemical processes in developing and manufacturing medicine, and as artificial replacements for body parts, in particular the artificial heart and penile prosthesis.

FRAME

Frame is back bone of the equipment. It is made of mild steel. All the sub-parts in the equipment are mounted in the shaft. It is the rigid structure that forms a skeleton to hold all the major parts together.

At the bottom end of the frame wheel with seed container assembly is mounted. In the frame, fertilizer container assembly is mounted and in the top of the frame handle and stand is mounted

STAND

Hollow pipe is used as a stand. Stand is used to support the equipment when it is not in moving. It is made of mild steel. There are two holes are provided in the top end of the stand and it is clamped with frame by using bolt and nuts.

The bottom end of the stand is enclosed with plate and it is support the stand. A hook is fixed in the fertilizer container. When we move the equipment at that time stand is clamped by using hook.

DC MOTOR

An electric motor is a machine which converts electrical energy to mechanical energy. Its action is based on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a magnetic force whose direction is given by Fleming's left hand rule.

When a motor is in operation, it develops torque. This torque can produce mechanical rotation. DC motors are also like generators classified into shunt wound or series wound or compound wound motors.

FLEMING'S LEFT HAND RULE

Keep the force finger, middle finger and thumb of the left hand mutually perpendicular to one another. If the fore finger indicates the direction of magnetic field and middle finger indicates direction of current in the conductor, then the thumb indicates the direction of the motion of conductor.

Principle Of Operation Of Dc Motor

Figure I show a uniform magnetic field in which a straight conductor carrying no current is placed. The conductor is perpendicular to the direction of the magnetic field.

In figure II the conductor is shown as carrying a current away from the viewer, but the field due to the N and S poles has been removed. There is no movement of the conductor during the above two conditions. In figure III the current carrying conductor is placed in the magnetic field. The field due to the current in the conductor supports the main field above the conductor, but opposes the main field below the conductor.

The result is to increase the flux density in to the region directly above the conductor and to reduce the flux density in the region directly below the conductor. It is found that a force acts on the conductor, trying to push the conductor downwards as shown by the arrow. If the current in the conductor is reversed, the strengthening of flux lines occurs below the conductor, and the conductor will be pushed upwards (figure-IV).

Now consider a single turn coil carrying a current as shown in the above figure. In view of the reasons given above, the coil side A will be forced to move downwards, whereas the coil side B will

be forced to move upwards. The forces acting on the coil sides A and B will be of same magnitude. But their direction is opposite to one another. As the coil is wound on the armature core which is supported by the bearings, the armature will now rotate. The commutator periodically reverses the direction of current flow through the armature. Therefore the armature will have a continuous rotation.

BATTERY

A battery is a self-contained, chemical power pack that can produce a limited amount of electrical energy wherever it's needed. The basic power unit inside a battery is called a cell, and it consists of three main bits. There are two electrodes (electrical terminals) and a chemical called an electrolyte in between them. For our convenience and safety, these things are usually packed inside a metal or plastic outer case. There are two more handy electrical terminals, marked with a plus (positive) and minus (negative), on the outside connected to the electrodes that are inside. The difference between a battery and a cell is simply that a battery consists of two or more cells hooked up so their power adds together.

CONTROL UNIT

In automotive electronics, Electronic Control Unit (ECU) is a generic term for any embedded system that controls one or more of the electrical system or subsystems in a motor vehicle.

Types of ECU include Electronic/engine Control Module (ECM), Power train Control Module (PCM), Transmission Control Module (TCM), Brake Control Module (BCM or EBCM), Central Control Module (CCM), Central Timing Module (CTM), General Electronic Module (GEM), Body Control Module (BCM), Suspension Control Module (SCM), control unit, or control module. Taken together, these systems are sometimes referred to as the car's computer. Technically there is no single computer but multiple ones. Sometimes one assembly incorporates several of the individual control modules.

Some modern motor vehicles have up to 80 ECUs. Embedded software in ECUs continues to increase in line count, complexity, and sophistication. Managing the increasing complexity and number of ECUs in a vehicle has become a key challenge for original equipment manufacturers (OEMs).

IV. PRODUCT DESCRIPTION

WHY?? Mild steel???

The term 'mild steel' is also applied commercially to carbon steels not covered by standard specifications. Carbon content of this steel may vary from quite low levels up to approximately 0.3%. Generally, commercial 'mild steel' can be expected to be readily weldable and have reasonable cold bending properties but to specify 'mild steel' is technically inappropriate and should not be used as a term in engineering. Mild steel is the most widely used steel which is not brittle and cheap in price. Mild steel is not readily tempered or hardened but possesses enough strength.

Mild steel Composition

- ✓ Mild steel contains –C45
- ✓ Carbon 0.35 to 0.45 % (maximum 0.5% is allowable)
- ✓ Manganese 0.60 to 0.90 %
- ✓ Silicon maximum 0.40%
- ✓ Sulfur maximum 0.04%
- ✓ Phosphorous maximum 0.04%
- ✓ Mildest grade of carbon steel or mild steel contains a very low amount of carbon - 0.05 to 0.26%
- ✓ Tensile strength – 63-71 kgf/mm²
- ✓ Yield stress -36 kgf/mm²
- ✓ Izod impact value min -4.1 kgf m
- ✓ Brinell hardness (HB) – 229

V. MANUFACTURING PROCESSES

Introduction:

Manufacturing involves turning raw material to finished products, to be used for various purposes. There are a large number of processes available. These processes can be broadly classified into four categories.

- 1 Casting processes
- 2 Forming processes
- 3 Fabrication processes
- 4 Material removal processes

Casting Processes:

These processes only processes where the liquid metal is used. Casting is also the oldest known manufacturing process.

Basically it consists of inducing the molten metal into a cavity of mould of the required form and allowing the metal to solidify. The object after solidification removed from the mould. Casting processes are universally used to manufacture a wide variety of products. Casting is the most flexible and cheapest method and given high strength of rigidity to the parts which are difficult to produce by other manufacturing processes. The principle process among these sand

casting where sand is used as the raw material. The process is equally suitable for the production of a small batch as well as on a large scale. Some of the other classified casting processes for specialized need are

- Shell mould casting
- Precision mould casting
- Plaster mould casting
- Permanent mould casting
- Die casting
- Centrifugal casting

Forming Processes:

These are solid state manufacturing processes involve minimum amount of material wastage. In forming process metal may be heated to temperature which is slightly below. This solidify temperature and large force is applied such the material flows and act in desired shape. The desire shape is controlled by means of a set of tool ties and dies, which may be closed during manufacturing.

These processes are normally used for large scale production rates. These are generally economical and in many cases improve the mechanical properties. These are some of the metal forming processes.

- Rolling forging
- Drop forging
- Press forging
- Upset forging
- Extrusion forging
- Wire forging
- Sheet metal operation

Fabrication Processes:

These are secondary manufacturing processes where the starting raw materials are produced by any one of the previous manufacturing processes desired. Its assembly involve joining pieces either temporary or permanent. So that they would be perform the necessary function. The joining can be achieved by either or both of heat and pressure joining materials. Many of the steel structure construction, we see are first rolled and then joined together by a fabrication process are

- Gas welding
- Electric arc welding
- Electrical resistance welding
- Thermo welding
- Brazing welding
- Soldering welding
- Cold welding

Material removal processes:

These are also a secondary removal manufacturing process, where the additional unwanted material is removed in the form of chips from the blank material by a hard tools so as to obtain the final desired shape.

Material removal is normally a most expensive manufacturing process. Because more energy is consumed and also a lot of waste material is generated in this process. Still this process is widely used because it deliver very good dimensional accuracy and good surface finished. Material removal process are also called machining processes. Various processes in this category are

- Turning
- Drilling
- Shaping and planing
- Milling
- Grinding
- Broaching
- Sawing
- Trimming

WELDING:

Welding is a process of joining two metal pieces by the application of heat. Welding is the least expensive process and widely used now a days in fabrication. Welding joints different metals with the help of a number of processes in which heat is supplied either electrically or by mean of a gas torch. Different welding processes are used in the manufacturing of Auto mobiles bodies, structural work, tanks, and general machine repair work. In the industries, welding is used in refineries and pipe line fabrication. It may be called a secondary manufacturing process.

Classification of welding processes:

There are about 35 different welding and brazing process and several soldering methods, in use by the industry today. There are various ways of classifying the welding for example, they may be classified on the basis of source of heat (flames, arc etc.)

In general various welding processes are classified as follows.

1: Gas Welding

- (a): Air Acetylene
- (b): Oxy Acetylene
- (c): Oxy Hydrogen Welding

2: Arc Welding

- (a): Carbon Arc welding
- (b); Plasma Arc welding
- (c): Shield Metal Arc Welding
- (d): T.I.G. (Tungsten Inert Gas Welding)

3: Resistance Welding:

- (a): Spot welding
- (b): Seam welding
- (c): Projection welding
- (d): Resistance Butt welding

4: Solid State Welding:

- (a): Cold welding
- (b): Diffusion welding
- (c): Forge welding
- (d): Fabrication welding
- (e): Hot pressure welding
- (f): Roll welding

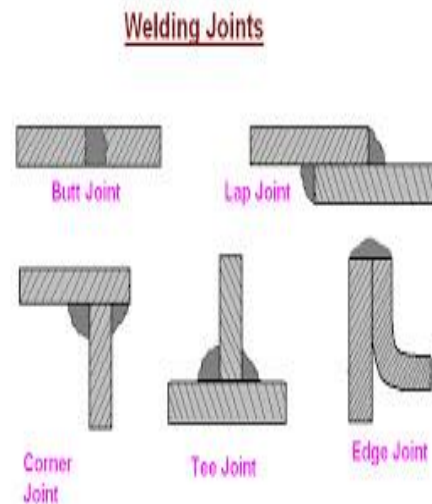
5: Thermo Chemical Welding

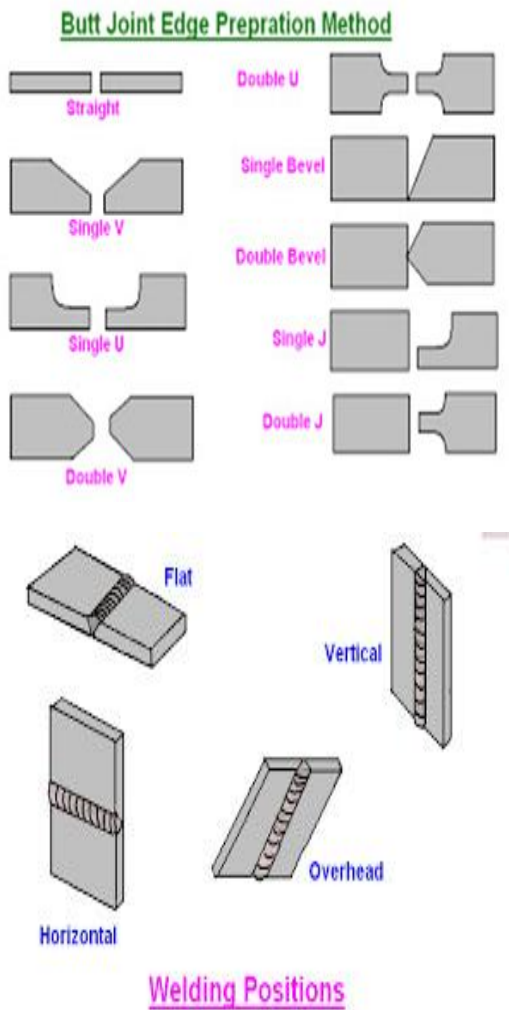
- (a): Thermite welding
- (b): Atomic welding

6: Radiant Energy Welding

- (a): Electric Beam Welding
- (b): Laser Beam Welding

Welding Joints:





DRILLING PROCESS:

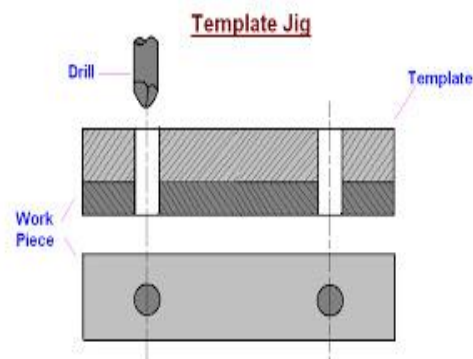
- Center drilling
- Deep hole drilling
- Gun drilling
- Trepanning
- Micro drilling
- Vibration Drilling

Types of Drilling Jigs:

1. Template jig
2. Plate type jig
3. Open type jig
4. Channel jig
5. Leaf Jig
6. Box type jig

1: Template Jig:

This is the simplest type of jig; It is simply a plate made to the shape and size of the work piece; with the require number of holes made it. It is placed on the work piece and the hole will be made by the drill; which will be guided through the holes in the template plate should be hardened to avoid its frequent replacement this type of jig is suitable if only a few part are to be made.



DRILLING:

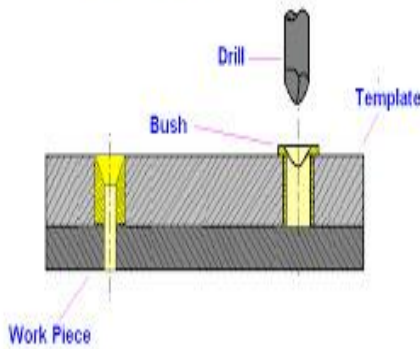
Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. The drill bit is usually a rotary cutting tool, often multipoint. The bit is pressed against the workpiece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the workpiece, cutting off chips (swarf) from the hole as it is drilled.

In rock drilling, the hole is usually not made through a circular cutting motion, though the bit is usually rotated. Instead, the hole is usually made by hammering a drill bit into the hole with quickly repeated short movements. The hammering action can be performed from outside of the hole (top-hammer drill) or within the hole (down-the-hole drill, DTH). Drills used for horizontal drilling are called drifter drills.

2. Plate Type Jig:

This is an improvement of the template type of jig. In place of simple holes, drill bushes are provided in the plate to guide the drill. The work piece can be clamped to the plate and holes can be drilled. The plate jig are employed to drill holes in large parts, maintaining accurate spacing with each other.

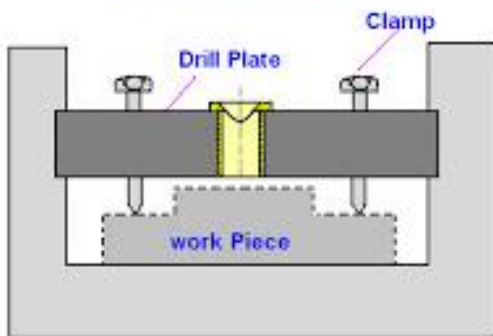
Plate Type Jig



3. Open Type Jig:

In this jig the top of the jig is open; the work piece is placed on the top.

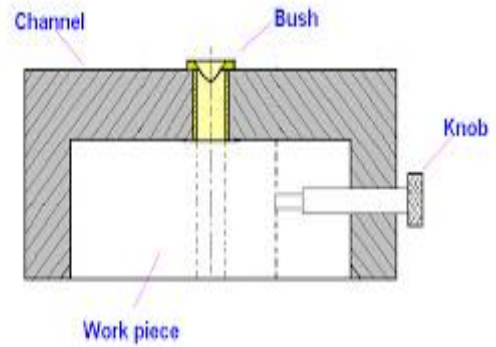
Open Type Jig



4. Channel jig:

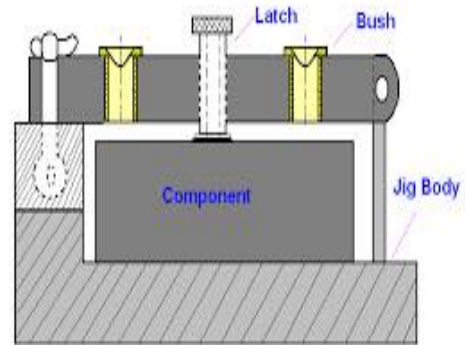
The channel jig is a simple type of jig having channel like cross section. The component is fitted within the channel is located and clamped by locating the knob. The tool is guided through the drill bush.

Channel Jig



5. Leaf Jig:

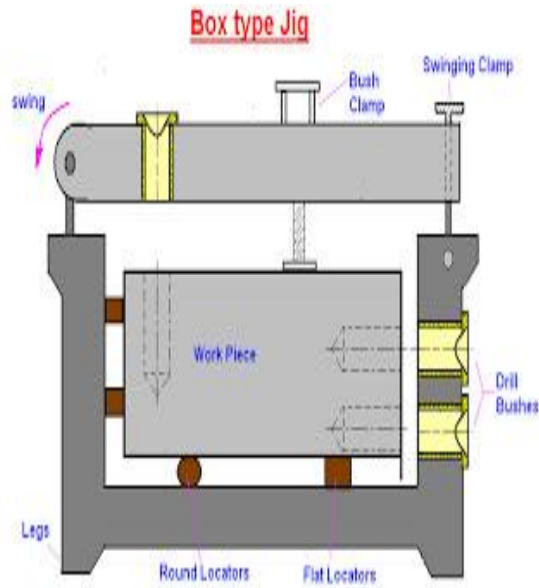
It is also a sort of open type jig , in which the top plate is arrange to swing about a fulcrum point , so that it is completely clears the jig for easy loading and unloading of the work piece.



Leaf Jig

6. Box Type Jig:

When the holes are to drill more than one plane of the work piece, the jig has to be provided with equalant number of bush plates. For positioning jig on the machine table feet have to be provided opposite each drilling bush plate. One side of the jig will be provided with a swinging leaf for loading and unloading the work piece, such a jig would take the form of a box.



METAL CUTTING OPERATIONS:

1. Blanking:

Blanking is the operation of cutting a flat shape from sheet metal. The product punched out is called the “blank” and the required product of the operation the hole and the metal left behind is discarded as waste.

2. Punching or Piercing:

It is a cutting operation by which various shaped holes are made in sheet metal. Punching is similar to blanking except that in punching, the hole is the desired product. The material punched out from the hole being waste.

3. Notching:

This is cutting operation by which metal pieces are cut from the edge of the sheet, strip or blank.

4. Perforating:

This is a process by which multiple holes are very small and close together are cut in a flat sheet metal.

5. Trimming:

This operation consists of cutting unwanted excess of material from the periphery of a previously formed component.

6. Shaving:

The edge of a blanked part are generally rough, uneven and un-square. Accurate dimensions of the part are obtained by removing a thin strip of metal along the edges.

7. Slitting:

It refers to the operation of making incomplete holes in a work piece.

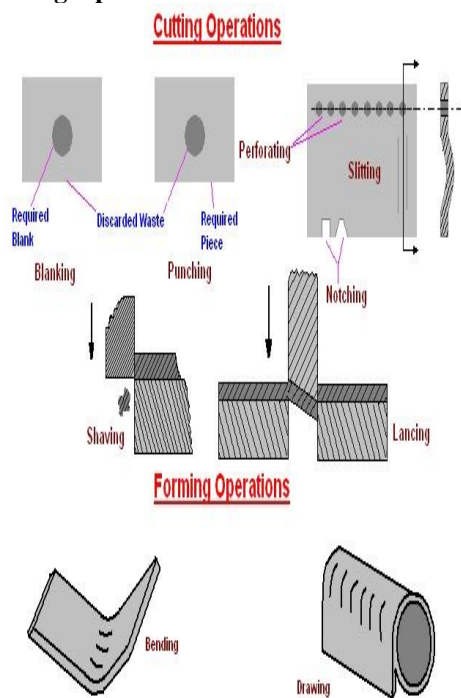
8. Lancing:

This is a cutting operation in which a hole is partially cut and then one side is bent down to form a sort of tab. Since no metal is actually removed and there will be no scrap.

9. Nibbling:

The nibbling operation, which is used for only small quantities of components, is designed for cutting out flat parts from sheet metal. The flat parts from simple to complex contours. This operation is generally substituted for blanking. The part is usually moved and guided by hand as the continuously operating punch cutting away at the edge of the desired contour.

Forming Operations:



1. Bending:

In this operation; the material in the form of flat sheet or strip is uniformly strained around a linear axis which lies in the neutral plane and perpendicular it's the length wise direction of the sheet or metal.

2. Drawing:

This is a process of forming a flat work piece into a hollow shape by means of a punch which cause the blank into a die cavity.

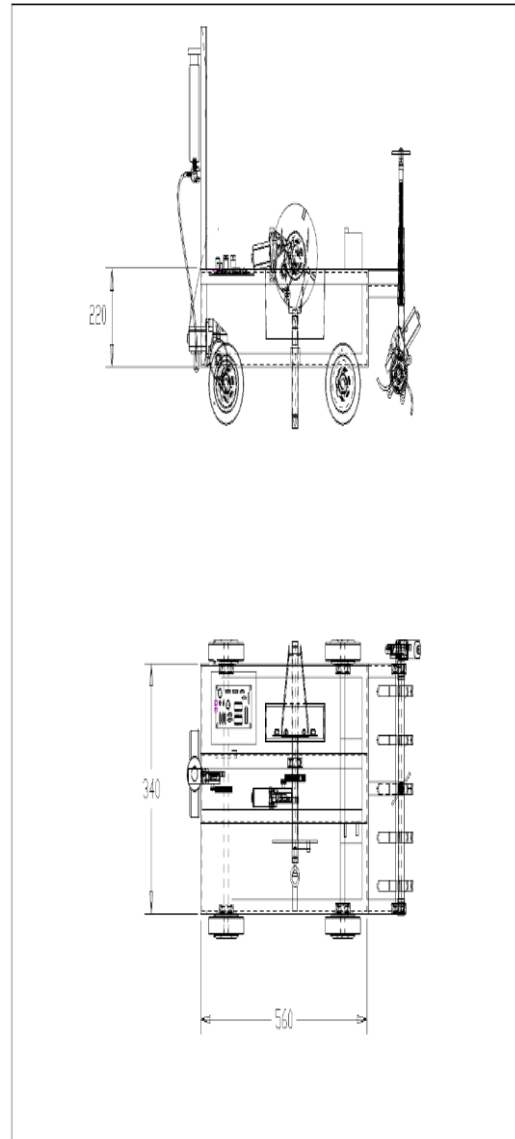
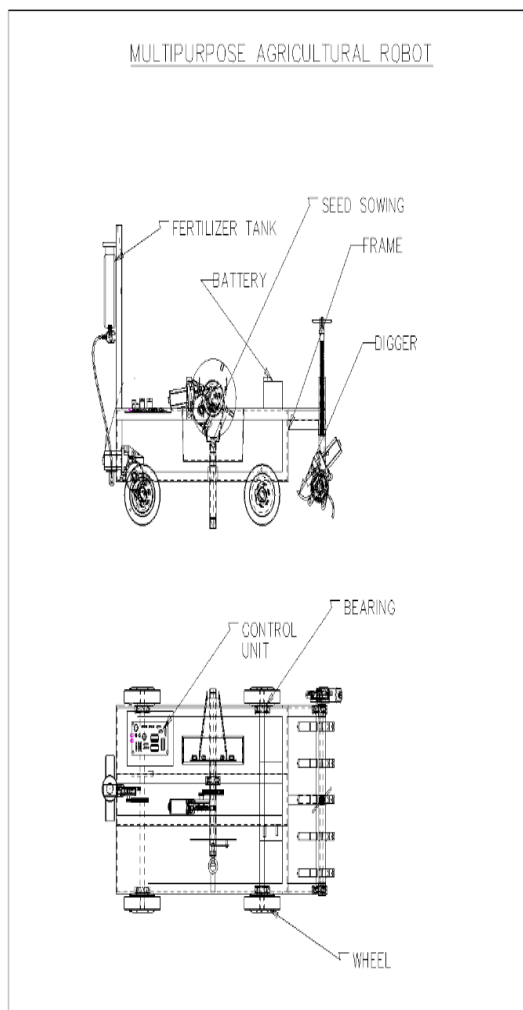
3. Squeezing:

Under the operation, the metal is caused to flow to all portions of a die cavity under the action of compressive forces.

VI. WORKING PRINCIPLE

This machine can able dig the ground and cut the grass ground and can sow the seeds and spray the water automatically. The seeds are fed manually in the hopper. The seed sower is connected with an impeller which sprays the seeds in the ground and the impeller is operated by a motor. In the front of the setup, it consists of set of blades, which is also operated by a motor which digs the ground. Then a sprinkler sprays the water and the pump delivers the water from the pump to the sprinkler. The digging and the seed spraying operation are controlled by an on/off switch. Another motor is provided for the movement of the setup. The digging operation is done first followed by the seed sowing operation and finally the water sprinkling operation is done. The power to the wheels is delivered by the battery and the motor. This operation is done by the help of RF controller.

2D DRAWING



VII. ADVANTAGES, DISADVANTAGES AND APPLICATIONS

ADVANTAGES

- Low cost.
- Easy construction.
- Easy to operate.
- No power is required.
- Solar energy is a renewable energy and the battery is charged continuously.
- Highly reliable.
- High efficiency.
- No need of skilled operators to operate this system.

DISADVANTAGES

- Maintenance is needed.
- Repairing and replacing is not an easy task.

APPLICATIONS

These types of solar operated automatic seed sowing machines have a wide range of applications in the fields like,

- It is applicable in agricultural for seed sowing.
- Applicable for agricultural areas are given below.

It can be used to sow the following seeds

- Ground nut seeds
- Lady’s finger seeds
- Maize
- Sunflower, etc.,

It can be used to spray the fertilizers

- Sugar cane plants
- Turmeric plants
- Vegetable plants
- Tapioca plants , etc.,

VIII. LIST OF MATERIALS

Sl. No.	PARTS	Qty.	Material
1	Battery	1	Lead acid
2	Motor	5	-
3	Sprayer set up	1	MS
4	Frame	1	M.S
5	Connecting links	3	MS
6	WHEELS	4	-
7	Spur gear	4	GCI
8	Bearing & bearing cap	8	MS
9	Water tank	1	PH
10	Cutter setup	1	MS

IX. COST ESTIMATION

1. MATERIAL COST:

Sl. No.	PARTS	Qty.	Amount
1	Battery	1	1200
2	Motor	2	2750
3	Sprayer set up	1	1800
4	Frame	1	1800
5	Connecting links	3	900
6	Wheel	4	1550
7	Spur gear	4	700
8	Bearing & bearing cap	8	600
9	Tank	1	200
10	Cutter setup	1	800
11	control unit	1	3500

Total =16000

2. LABOUR COST

LATHE, DRILLING, WELDING, GRINDING, POWER HACKSAW, GAS CUTTING:

Cost = 4000

3. OVERHEAD CHARGES

The overhead charges are arrived by “Manufacturing cost”

Manufacturing Cost=Material Cost+ Labour cost

$$=16000+4000$$

$$=2000$$

Overhead Charges=20% of the manufacturing cost
=4000

TOTAL COST

Total cost=Material Cost + Labour cost +overhead charges
=16000+4000+4000
=24000

Total cost for this project=Rs. 24,000

X. CONCLUSION

A strong multidiscipline team with a good engineering base is necessary for the Development and refinement of advanced computer programming, editing techniques, diagnostic Software, algorithms for the dynamic exchange of informational different levels of hierarchy.

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work.

We are proud that we have completed the work with the limited time successfully. The “FULLY AUTOMATIC MULTIPURPOSE AGRICULTURAL VEHICLE” is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality.

We have done to our ability and skill making maximum use of available facilities. In conclusion remarks of our project work. Thus we have developed a “FULLY AUTOMATIC MULTIPURPOSE AGRICULTURAL VEHICLE”. By using more techniques, they can be modified and developed according to the applications.

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