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Design & Fabrication of Movable Water Reel Sprinkler Irrigation System

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Abstract

Ever since man has started use of modern methods of farming there was always a problem of doing water irrigation simple and less time consuming as well as effortless. Efforts are taken to solve this problem movable water reel sprinkler irrigation is a simple method used now a days. It assist growing of crops, maintaining landscapes and re-vegetation of disturbed soil in dry areas. The main aim of our project is to reduce the efforts required for irrigating on large acre of land. In low lying areas where there is water shortage drip irrigation cannot be incorporated for irrigation purpose. As a result the farmers in these areas make use of flexible pipes which can be connected and disconnected this increases the cost associated with labour and is also a time consuming process.Other problems like ground furrows causes wastage of water this may lead to soil erosion. The initial and operation cost of drip irrigation is slightly expensive. In case of chocking of this pipes entire pipe has to be inspected this increases the maintenance cost.

This movable water reel sprinkler irrigation system is a step towards solving the above mentioned problems .This systemwhich works on principle of

pressurizing water and sprinkling through separate attachment of sprinkler. With help of this water sprinkling as well as fertilizing will be more easy and done with negligible efforts.

Keywords: *Water reel, Irrigation, Less time consuming, Effortless*

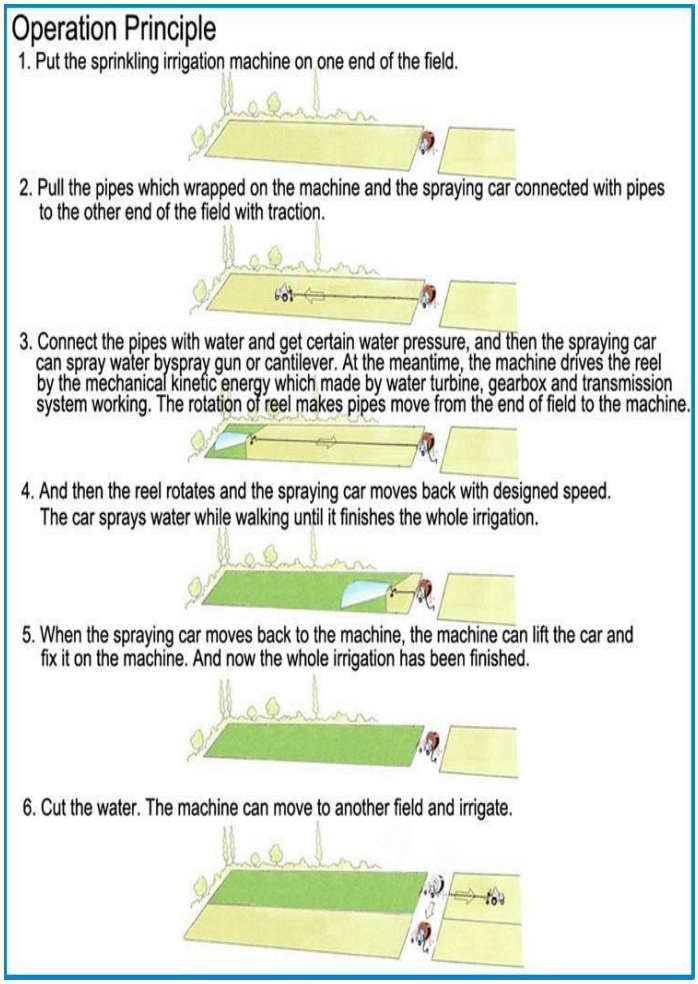
I. INTRODUCTION

This project is modification done in irrigation system which reduces cost of working which was more taken in drip irrigation.In sprinkler irrigation the high pressure sprinkler receives water from drum which is centrally located at one location of the field and the water is pumped to the next location to the sprinklers A system which utilizes sprinkler or guns mounted overheated on permanent install rotors are often known as solid state irrigation system rotors are the high pressure sprinklers that rotates about their own axis and are ball driven , gear driven impact mechanism rotors will be designed to rotate during a full or partial circle spray guns are like rotors, except that they are normally driven at a really high speed and pressure of about 40 to 131 LBS per inch (270 to 910 kilo Pascal)and flows to of 52 to 1200 us gallons per minute 32 to 76 litres per second usually unusual diameter in a range of 0.52 to 1.93 inches (13.208 to 49.022 mm)is use spray nozzles are used for irrigation and also for industrial applications such as the separation

The sprinklers have a host pipe connected to it for water source. This attachment with sprinkler can be mounted over the moving carriage. This moving carriage over which the sprinkler is mounted can be moved in garden, playgrounds, small farms, stadiums etc.

The length which is travelled by using the pipe tube mounted over the Steel drum. The tubing is powered by irrigation water and moveable attachment on which the sprinkler is mounted is forced across the area and the system shuts off the machine after it returns back at the reel of machine. This type of system is believed as movable water reel automaton irrigation system and there extensively used for land application of wastewater, dirt suspension and irrigation

2. PRINCIPLE OF OPERATION



(Figure 1. Principle of operation of the system)

3. DESIGN OF VARIOUS COMPONENTS AND IT'SSPECIFICATION

3.1. Design of shaft

Internal Diameter Of Shaft= 26mm

External diameter of shaft= 30mm

Length of shaft= 46mm

Weight of pulley= 2kg x 9.81= 19.62

M= bending moment in N.mm

6b= bending stress in N/mm

Since shaft is subjected to bending moment only, consider shaft as a beam which is equally supported at ends.

3.2. Reservoir (Tank)

A rectangular tank made of stain less steel was selected as the reservoir. The purpose

of selecting rectangular tank was easy assembly (mounting) of tank on the column of the frame. The inlet and outlet ports are provided on the tank.The tank is bolted and mounted on frame. There is a rectangular opening on top surface of tank, it is provided for cleaning purpose.

Figure 2 Actual image of tank

Dimensions

TOTAL HEIGHT	304mm
TOTAL LENGTH	660mm
TOTAL WIDTH	355mm

3.3. Frame and Wheel Assembly

It is the base of the entire system on which the other components of system are mounted. There are four column provided on top of the frame so that the reservoir can be mounted on it. Four wheels are mounted on sides of frame. A lower compartment is provided for mounting battery, inverter, pump and small container to store fertilizer. The frame is made of mild steel.

Figure 3 Actual image of frame

Dimensions

FOR FRAME-

TOTAL HEIGHT	317mm
TOTAL LENGTH	1140mm
TOTAL WIDTH	457mm

FOR WHEEL-

WHEEL DIAMETER	508mm
WHEEL THICKNESS	40mm

3.4. Water Pump

- Wall /Floor Mount: Yes
- No of Stitch Functions: 1 TO 1
- No of Step Button Holer: 0
- No of Built-In Stitch Patterns: 1 To 1
- Motor: 1 Hp
- Length: 42

- Free Arm for Circular Stitching: No
- Dimensions: 42x 30x 32 cm
- Auto Needle Threader : No
- Type: Water Pumps
- SUPC: SDL195414760
- Copper winding
- 3-phase AC 6A 240V

Figure 4 Image of pump

3.5. Reel Assembly

Provisions are made on the frame for mounting of reel assembly. Two supports are mounted on the frame. The axle is fitted on supports on which reel (pulley) is mounted. The material used for reel is wood.

A PVC pipe of 30 metre is wound on the reel. By rotating the reel the pipe can be winded or un-winded and accordingly the distance of travel by hose cart assembly can be adjusted.

(Figure 5 Reference image of reel)

Dimensions

FOR REEL (PULLEY)-

OUTER DIAMETER	430mm
INNER DIAMETER	230mm
LENGTH	240mm

FOR PIPE-

INTERNAL DIAMETER	16mm
LENGTH	30000mm

3.6. Hose Cart Assembly (Movable Sprinkler)

A triangular cart having two wheels at back and stopper at front. The sprinkler is mounted on pipe at centre of cart. The sprinkler is made of brass material and has a operating range of 40 fit (diameter)_The cart is made of mild steel..A handle is

provided in front of the cart in order to pull the cart to the desired distance.

(Figure 6. Actual image of sprinkler arrangement)

DIMENSIONS:

LENGTH OF EACH SIDE	350mm
HEIGHT OF SPRINKLER FROM BASE	250mm

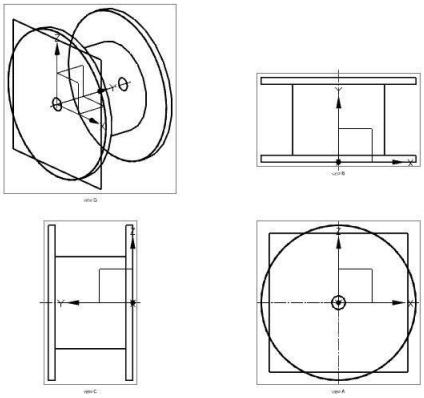
3.7. Fertilizer Sprayer

- Fertilizer or insecticide is placed directly into the bottle, set dial according to dilution required and activate spraying
- Black nozzle can be adjusted for different angles
- Ideal for large garden areas such as lawn or multiple garden beds
- No messy mixing required
- Instructions are enclosed

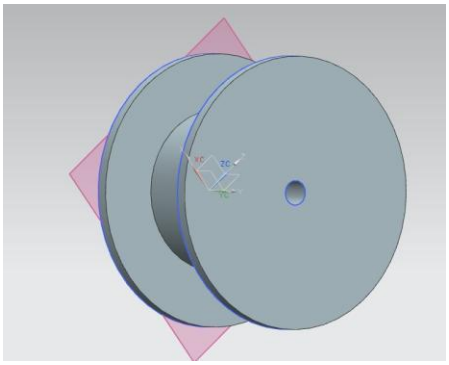
(Figure 7. Refernce image of spray nozzle)

4. DRAWING DETAILS

4.1. Water Reel

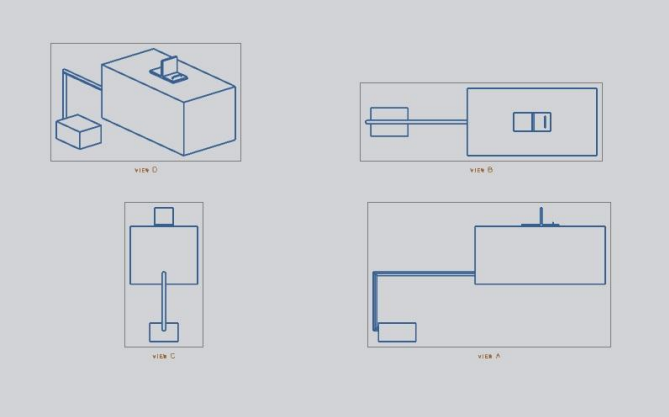


(Figure 8. 2Ddrawing of water reel)

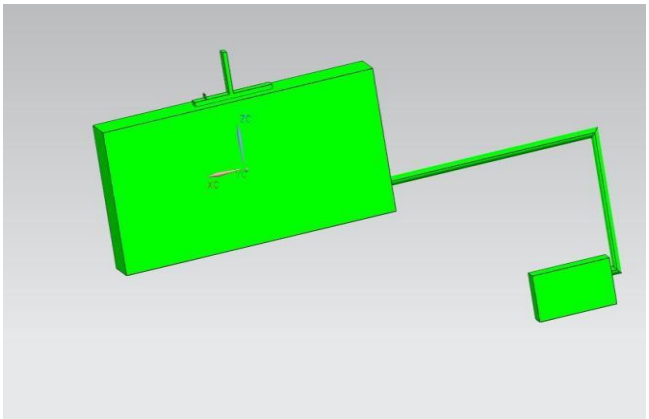


(Figure 9. 3Ddrawing of water reel)

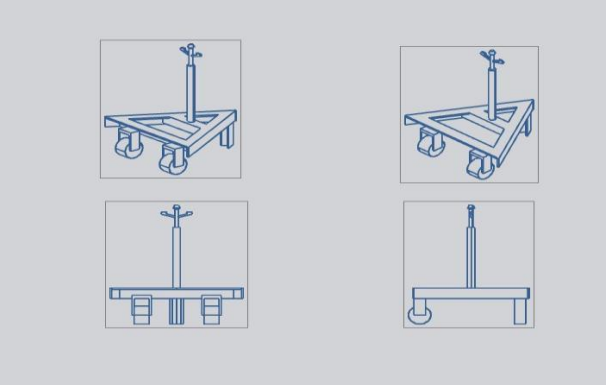
4.2. Reservoir Tank:-



(Figure 10. 2D drawing of reservoir tank)



(Figure 11. 3D drawing of reservoir tank)



(Figure 12. 2D 3Ddrawing of sprinkler with attachment)

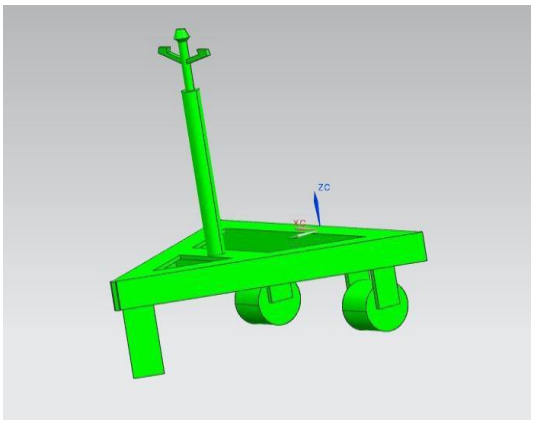


Figure13. 3Ddrawing of sprinkler with attachment

4.4. Main Frame (Chasis) :-

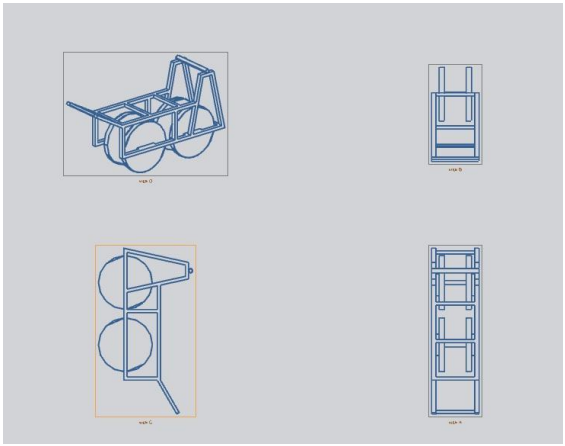


Figure 14 3Ddrawing of chasis

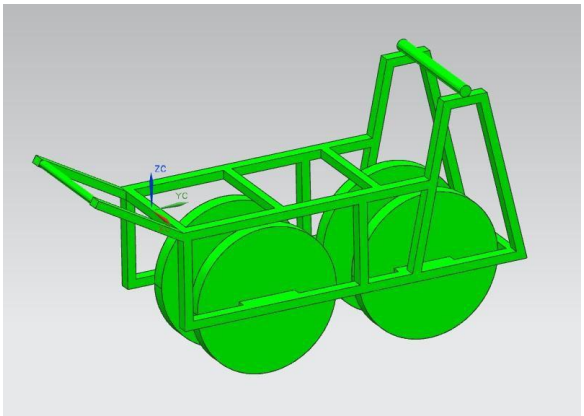


Figure 15 3Ddrawing of chasis

4.5 Assembly Drawing

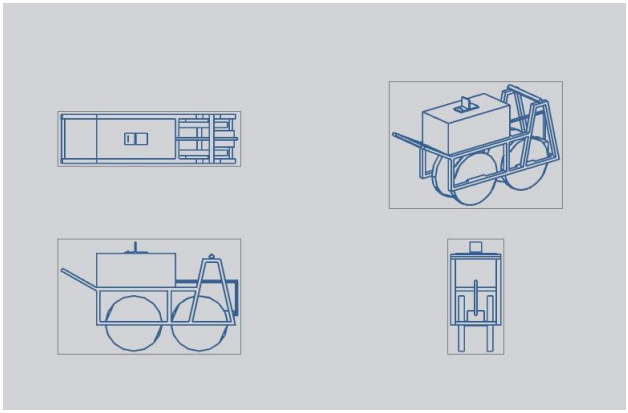


Figure 16 2D drawing of final assembly

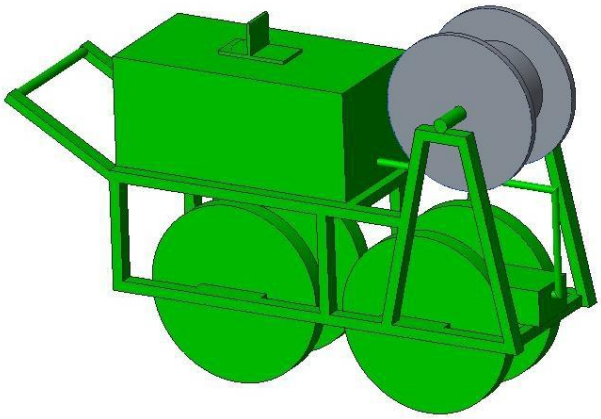


Figure 17 3D drawing of final assembly

Figure 18 Actual image of fabricted water reel

5. TIME OF OPERATION AND FLOW RATE

This sprinkler guns are mostly designed to operate for 60 to 90 hours per week. Irrigation for those long periods allow the smaller traveler to be used to cover more area which in turn means a lower initial cost for the equipment. Travelers can be sized to irrigate the required area in 40 to 50 hours each week or less but the cost of the system for acre is quite hire in those cases and can make the system economically unattainable.

The labour required to keep a travelling gun irrigation is 12 hours maximum and 7 hours minimum a day can be estimated so that every user should first estimate the labour time available before deciding on irrigation time. Many times a single long pool with the traveler me take it to 10 hours to apply the necessary amount of water so in such cases the labour requirement should be simply setting up the traveler once a day checking for it anabasis shows several times during Innovation and turn off the system moving the system two or three times per day most often due to shorter pull increases the labour need considerably

The time irrigation for week shown in the table given below the required flow rate and the water required needed for irrigation is shown in the figure the system is expensive so the table shows the 75% of application efficiency of Huge machines and bigger flow rates and it's bigger piping and huge pumps

Table No1 time of irrigation per week, amount of water applied, and flow rate required to accomplish that irrigation amount in the specified time frame)

Acres Irrigated	Net Irrigation Amount (inches)	Time to Irrigate (hours per week)	Flow Rate Req'd (gpm)
5	1	40	75
		60	50
		90	34
	1.5	40	113
		60	75
		90	50
10	1	40	151
		60	101

		90	68
	1.5	40	226
		60	151
		90	101
50	1	40	754
		60	503
		90	335
	1.5	40	1131
		60	754
		90	503

6. TESTING AND CALCULATION

- Discharge of pump - 100litres/min
- Maximum distance travelled by sprinkler from reservoir- 29m
- Maximum width covered by sprinkler (wetted diameter)- 13.33m
- Irrigated width- 12m

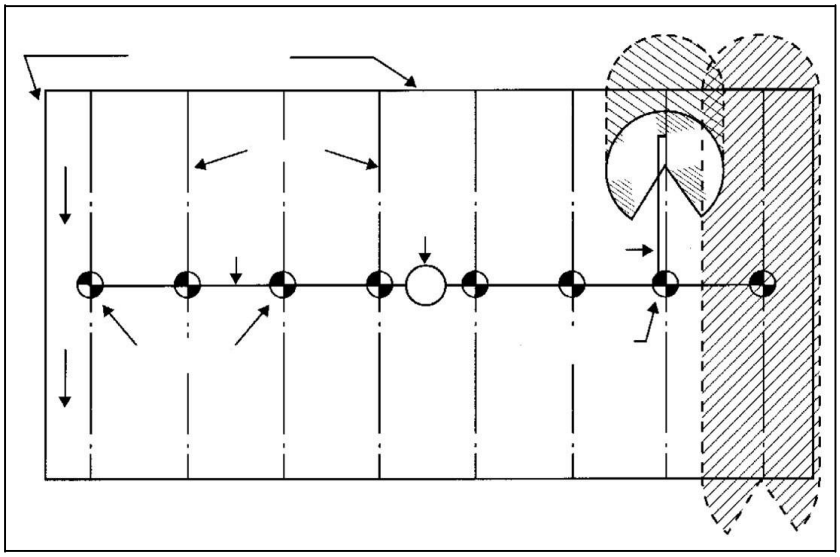


Figure 19 Area irrigated by sprinkler

Maximum area irrigated by sprinkler
=area of rectangle (abcd) + area of semi circle with centre o
=(29m X 12m) + (3.14 X 62)
=348m2 + 113.04m2
=461.04m2

7. FUTURE SCOPE AND IMPROVEMENTS

- The assembly can be made light in weight by using lighter materials such as aluminium.
- The process can be automated by using sensor and timer system as well as remote controlled mechanism.
- It can be made more rigid by making further improvement in the design .
- Making use of solar panel will make it more friendly to environment.
- Reel Irrigation System works on a self-propelling mechanism, there is a hose pipe which is rolled on a reel, and attached to a rain gun with wheels attached to it.
- The reel retracts itself and at the same time irrigates the field /crop while retracting, the retraction is either with the help of turbine machines using the water pressure or can also have additional booster pumps depending on the size of the rain gun and the area to be covered.
- A multiple sprinkler can be attached to the pipe of reel. This can help to increase the irrigated area.
- Use of variable pump can help to increase or decrease the irrigated area by varying the discharge pressure.

CONCLUSION

- Most collective irrigation systems cannot adopt crop-based and water saving irrigation scheduling methods in view of the lack of reliability and flexibility in water supply.
- Reliable water supply demands a technically good design, which is adjusted to local conditions, good quality construction and proper operation and maintenance.

- Equity in water supply is seldom achieved due to the inadequacy of adjustable outlets in functioning properly over a wide range of flow, the wide deviation of scheduling practices, loose management.

- Simple operational procedures may provide short-term solutions to improve reliability of supply, but long-term solutions need to be found in modernization and automation of the irrigation system.

- The lack of adequate flow control and measurement devices are main constraints in introducing effective water supply.

- Several good concepts, methods and equipment are available, but not yet widely introduced due to lack of knowledge and understanding of available techniques.

- Integral computer models are useful for project planning, design and evaluation, but have proved too cumbersome for day-to-day operation.

- The cost of irrigation modernization cannot be borne by farmers alone.

The evaluation of the actual water management criteria normally applied by the user, reached lows values of both, application and total distribution efficiencies, 58.65% and 61.0%, respectively, settling as a result a management factor status equals to “Less than good”. Using INNOVA RIEGO, these values were improved up to values of 95.89% for application efficiency and 94.61% for total distribution efficiency, accomplishing anExcellent management factors status, taking the furrow discharge, cut back discharge, cut of time and furrow length as decision support variables. The results achieved, exposed that the user was able to improve his farm water management, reaching sustainable results, reducing significantly the quantities of percolation and surface runoff, and increasing the irrigation efficiencies.

In consequence, INNOVA RIEGO is a computational tool that can assists adequately the decision making process, improving the efficiency of water management, supporting the sustainability of the farm, and give flexibility to the

agricultural activity as well as proper information for the management of the resource. available water

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