Available online at www.elixirpublishers.com (Elixir International Journal)

Mechanical Engineering

Elixir Mech. Engg. 90 (2016) 37289-37291

ISSN: 2229-712X

Design and Modeling of Bundle Making Machine for Drip Irrigation System

Rahul Kawalkar, Duleshwar Sahu, Sachin Pardhi, Dushant Dhole, Monal Bhagat, Suraj Fating, Suraj Bondade and C.K.Tembhurkar

Priyadarshini College of Engineering, Nagpur, India.

ARTICLE INFO

Article history:

Received: 1 April 2015;

Received in revised form: 24 December 2015;

Accepted: 30 December 2015;

Keywords

Drip irrigation,
Irrigation tubes,
Collection process,
Sprinkler,
Bundle making machine.

ABSTRACT

In our country most of the population has agriculture as a primary source of income. Agricultural output consist of 16% of India GDP but in most parts of our country there is scarcity of water. To give boost to agriculture the earliest leaders of the country had given primary importance to irrigation projects. But day by day it's becoming need of the hour to utilize micro irrigation techniques like drip and sprinkler irrigation. In our country most of the farmers utilize conventional process of pipe collection. But it effects the life of pipes, while collecting the pipes it forms scratches, minute holes, bends and while utilizing next time its efficiency has been decreased so these paper deals with the application of a simple mechanism to coil the pipes and collect it without bending or forming twist and increasing its efficiency and long life. It deals with very basic but un-noticed problem related to drip irrigation pipes.

Introduction

Drip irrigation, also known as trickle irrigation or micro irrigation or localized irrigation, is an irrigation method that saves water and fertilizer by allowing water to drip slowly to the roots of plants, either onto the soil surface or directly onto the root zone, through a network of valves, pipes, tubing, and emitters. It is done through narrow tubes that deliver water directly to the base of the plant. These tubes are spread in the fields at a wide distance, from where water from tubes comes out drop by drop from small holes of tube. For installing these tubes labors are needed. We are making this project for coiling of drip irrigation tubes, so that it can reduce wastage of time of farmer.

Methodology

The methodology of this mechanism is very simple .In current process at the end of season, collection of tubes is done manually. For collecting the tube we first attach the tube to one end of wheel of the mechanism. Then wheel is to be rotated in clockwise direction to wound the tube on circumference of the wheel. In current process during making bundles of tubes, tubes get bend, cut & their pores get blocked. Due to larger diameter of wheel, the tube wounded on wheel never twist, bends or forms leakages and tube cross section remains same for life time.

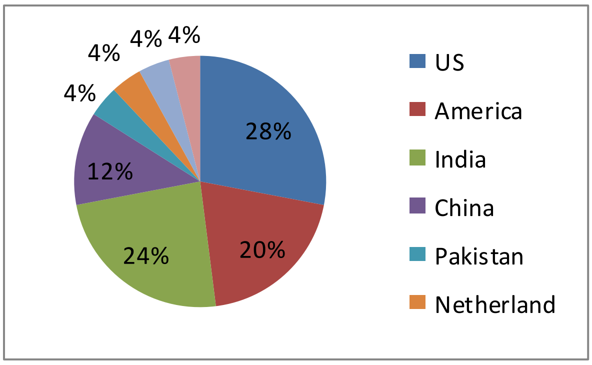

Fig 1. Pie-chart of literature survey country wise

Tele:
E-mail addresses: rahulkawalkar@gmail.com

Design Calculation

For big bearing

- Given : Fa= 176.58 N
- Fr= 200 N
- D= 25 mm
- Let, Ks= 2 (moderate shock)
- Equivalent Load :
- Fe= (XFr + YFa) . Ks . Kp . Ko . Kr
- where,
- e= Fa/Fr = 176.58/200 =0.88>0.25
- X= 0.56 & Y= 1.6 (T-XIII-14)
- Various Factors in Bearing load calculations:
- Fe= (0.56 x 200 + 1.6 x 176.58) x 2
- Fe= 789.05 N
- Rated Life:
- $L_{10} = (C/Fe)^n \times K_{rel}$
- where,
- n= 3 ; K_{rel} = 1 ; C= 16600
- $L_{10} = (16600/ 789.05)^3 \times 1$
- L_{10} = 9311 mpr
- Average Life :
- Let reliability of 50% of Avg. Life
- $L_{avg} = K_{rel} \times L_{10} = 5 \times 9311$
- L_{avg} = 46555 mpr

For Small Bearing

- Given : Fa= 490.5 N
- Fr= 520 N
- N= 500 rpm
- D= 15 mm
- Let, Ks= 2 (moderate shock)
- Equivalent Load :
- Fe= (XFr + YFa) . Ks . Kp . Ko . Kr
- where,
- e= Fa/Fr = 490.5/520 =0.94>0.25
- X= 0.56 & Y= 1.6 (T-XIII-14)
- Various Factors in Bearing load calculations:
- Fe= (0.56 x 520 + 1.6 x 490.5) x 2

Table 1. Literature survey of different countries

Name of Country	No .of papers
US	7
America	5
India	6
China	3
Pakistan	1
Netherlands	1
Brazil	1
Afghanistan	1

Table 2. Bearing Calculations (Big Bearing)

Sr no.	Item	Constant
1	Oscillation factor, Ko Constant rotational speed of races	1.0
2	Preloading factor, Kp Non preloaded bearing	1.0
3	Rotational factor, Kr Outer race fixed inner race rotating	1.0
4	Service factor, Ks Moderate shock load	2.0

Sr no.	Item	Constant
1	Oscillation factor, Ko Constant rotational speed of races	1.0
2	Preloading factor, Kp Non preloaded bearing	1.0
3	Rotational factor, Kr Outer race fixed inner race rotating	1.0
4	Service factor, Ks Moderate shock load	2.0

- Fe= 2152 N
- Rated Life:
- L10 = (C/Fe)n x Krel
- where,
- n= 3 ; Krel = 1 ; C= 8800
- L10 = (8800/ 2152)3 x 1
- L10 = 68.37 mpr
- Life in hours :
- L10 = Lhr x 60 x N / 106
- 68.37 = Lhr x 60 x 15 / 106
- Lhr = 75966 hr
- Average Life :
- Let reliability of 50% of Avg. Life
- Lavg = Krel x L10 = 5 x 68.37
- Lavg = 341.85 mpr

CAD Model

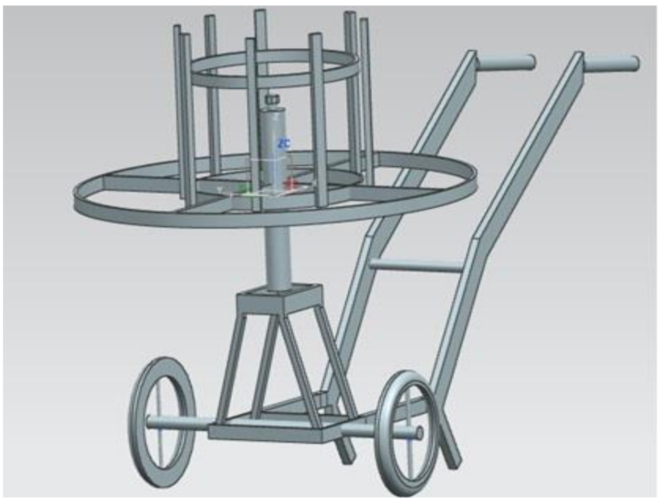

Fig 2. Cad model of machine

Specification

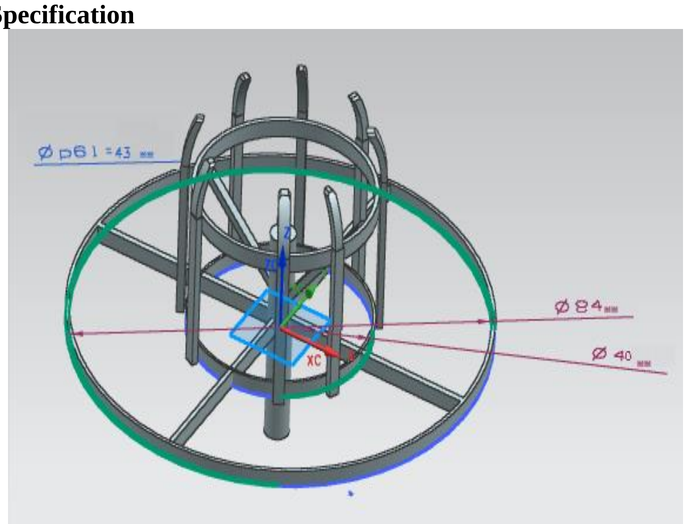

Fig 3. Upper rotating wheel

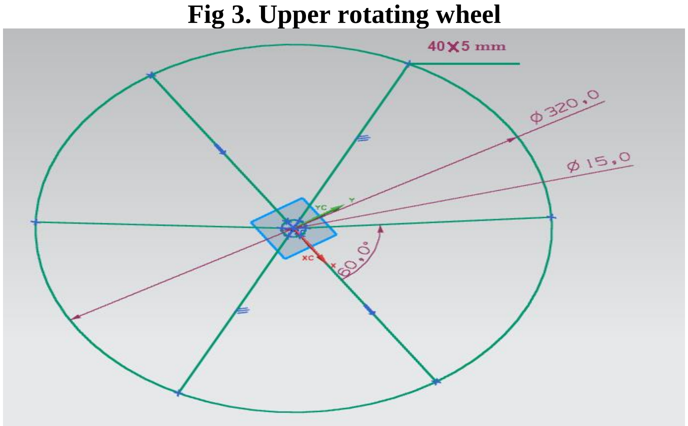

Fig 4. Base wheel

Fig 5. Assembled View of Bundle Making Machine

Working

The operation is very simple, in conventional process we do the coiling of tubes manually but with the help our bundle making machine. We tie one end of the tube to the upper flange of machine with the help of a small rope. Then we rotate handle of the machine in circular manner, with it the flange also start rotating on which irrigation tubes are coiling automatically.

Advantages

- Damage of tube due to bending can be reduced.
- Life of tubes can be increase.
- Tubes collection time can be reduce
- Labour cost can be reduce
- Smooth and continues collection of tubes can be done.
- Mechanism is light in weight.
- Mechanism is portable

References

1]Leon Bernstein & L. E. Francois, Comparisons of Drip, Furrow & Sprinkler irrigation, , 1972, US.

2]Octavian P. Dumitrascu & Charles A. MC Millen, Drip irrigation tube, 1992, US.

3]Bruno Buluschek, Method for manufacturing drip irrigation tubes, 1998 US.

4]Raphae-,Mehoudar Process of making a drip irrigation conduit The emitter units being 1991 US.

5]Raphael Mehoudar, Process of making a drip irrigation conduit , 1991 US

6]Gideon Gilead ,Irrigation apparatus 1978 US James C. Roberts , Drip irrigation tape and method of manufacture 1994 US

8] Defrank Michael, Irrigation tube with flexible margin, 2000 US

9] Victor A. Gillespie & Allan L. Phillips, Drip Irrigation Design Equations 1979 America

10] J. Simunek and P. J. Shouse , Comparison of HYDRUS-2D Simulations of Drip Irrigation 2004 America

11] DM Weatherspoon, CC Harrell, Evaluation of drip irrigation for container production of woody landscape plants 1980 America

12] R. K. Sivanappan , Prospects of micro-irrigation in India 1994 India

13] P Polak, B Nanes, D Adhikari , A LOW COST DRIP IRRIGATION SYSTEM FOR SMALL FARMERS IN DEVELOPING COUNTRIES 1997 India

14] B. D. Dhawan , Technological change in Indian irrigated agriculture: a study of water saving methods. 2002 India

15] J Burney, L Woltering & M Burke , Solar-powered drip irrigation enhances food security in the Sudano–Sahel2011 India