

Design and Fabrication of Roboreel

Aniket Kamble¹, ViditaRaut², Rahul Rathod³, Rohan Pandey⁴, Sanjay Lohar⁵

University of Mumbai,

V.C.E.T., Vasai Road (W), Palghar, Maharashtra

Corresponding Authors: *aniketkamble72@gmail.com¹, viditaraut@gmail.com², rathodr6666@gmail.com³
rohan.pandey2502@gmail.com⁴, sanjay.lohar@vcet.edu.in⁵*

Abstract

Gardening is one of the hobby of people. In earlier days people used small water tanks for watering plants. As technology progressed people started using pipes for watering plants. But it was one of the tedious tasks as to carry the pipe to the garden. It required a lot of human effort to carry the pipe. Pipes were damaged due to knots produced if they were not placed properly. Also it was time consuming job.

To overcome this problem, reels were produced due to which the pipes were wound manually and kept properly. But when the pipe was unwound it took lot of effort and time to again wound the pipe manually. To overcome all this problems roboreel is designed which automatically retract the pipe so that less effort is required for wounding the pipe. A ratchet and pawl mechanism is used by which the pipe can be held at a particular length for use. Clock spring mechanism is use for automatic retraction of the pipe. By using roboreel, human effort and time require for wounding pipe will get reduce at great extent.

Keywords: *Less effort, Reduce time.*

1.INTRODUCTION

In previous years gardening was very much complicated task which required too much human effort to wound pipe. Carrying pipe

at every place is very tedious job also carrying of hose reel was also not possible. After gardening to carry the pipe is difficult task and all these process requires more

effort. Sometimes pipe get damaged due to knot produced in pipe. To minimize damage and effort reels are introduced but still the problem is reels which are manufactured were not portable that means once we placed it at inlet we cannot move it to different place. Due to all these problems introducing in conventional method we want automation in gardening process.

Roboreel is the solution to all these problems. It is new technique of gardening. Roboreel is a portable version which we can move to any places easily. For retracting of pipe we just have to pull the pipe and release it will automatically retract.

2. PROBLEM DEFINATION

Generally gardening is just like hobby of people. Few years ago people who like gardening used small water tank or pipes for watering plants which was very tough or complicated to carry. It also required too much effort for carrying purpose and also during wounding of pipe or hose it required human effort. As we progressed technology was improved and reels were manufactured. The purpose or use of reel is only for pipe wounding but at that pipe wounding was too complicated as when without the reel pipe

wounding carried out created certain knots in pipe which was the main reason of pipe damage. Due to reel, the knots producing in pipe got eliminated but the process of wounding the pipe remained manual in those days.

3. METHODOLOGY

Construction-It consists of a reel of circular shape on which the pipe is wounded. The reel is placed in the casing and the inlet of the reel is connected to the outlet of pump. It has a clock spring which is made of alloy steel.

Components:

- Reel
- Pipe
- Timer circuit
- Clock spring
- Casing
- Pump

4. THEORETICAL EVALUATION

A. Selection of pipe

Standard pipe material= rubber

Half inch pipe

16m length

4.1 Hose length calculation

$$N = \frac{L}{D_p} = \frac{185}{21.33} = 8.67mm$$

$$N = 8$$

As shown in the figure, the net height „h“ gained by the next set of turns is

Actual length of drum covered = $8 \times 21.33 = 170.64mm$

$$\text{Clearance} = 185 - 170.64 = 14.36mm$$

Therefore, there is 7 gaps between 8 turns

Therefore, clearance between two turns =

$$\frac{14.36}{7} = 2.05mm$$

Length of hose for one set of turns around the drum or cylinder (l_p),

$$= \pi \times (D_c + D_p) \times N$$

$$= \pi \times (260 + 21.33) \times 8$$

$$= 7.07m$$

(a) Consider the case that the next set of turns of the hose is in the grooves of adjacent turns of the previous set of turns.

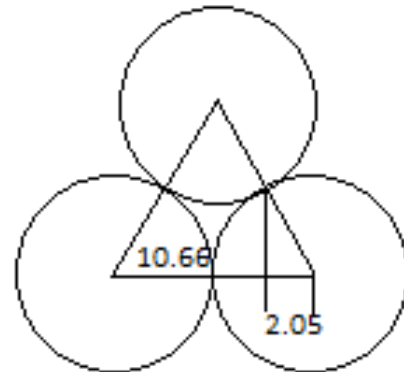


Fig 1 Placement of adjacent layer of hose

Net height „h“ gained by next set of turns = $10.66 \sin \theta$

Therefore,

$$\cos \theta = \frac{(10.66 + 1.025)}{21.33}$$

$$\cos \theta = 0.5478$$

$$\theta = 56.78$$

Therefore,

$$H = 10.66 \sin 56.78$$

$$= 8.91mm$$

Therefore,

$$D_d = D_c + (2 \times H)$$

$$= 260 + (2 \times 8.91)$$

$$= 279.62$$

For safety we are designing for 450mm

In this case of hose accumulation in groves, $\frac{n}{2}$ sets of turns will contribute D_p to the total height of the hoses while the remaining $\frac{n}{2}$ sets of turns will contribute $h + R_p$ to the total height.

$$D_d - D_c = D_p + \frac{n}{2} \times (h + R_p)$$

$$\therefore 450 - 260 = \frac{n}{2} \times (21.33 + 8.91 + 10.665)$$

$$\therefore n = 9.28$$

\therefore Max 9 set of turns are possible.

$$\therefore \text{Total length of hose} = n \times L_p = 9 \times 7.07$$

$$\therefore L_p = 63.63\text{m}$$

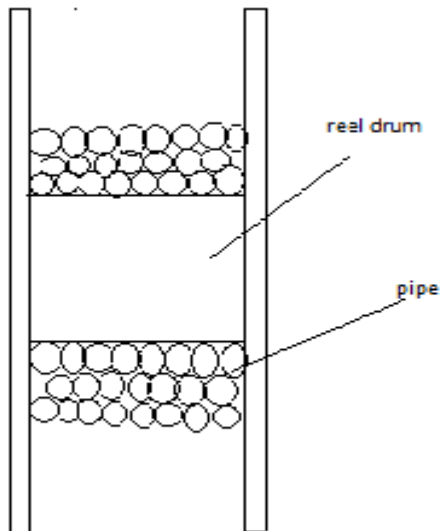


Fig. 2 Wounding of hose on hose on reel

(b) Consider the case that the next set of turns of the hose is exactly on top of an

initial turn. In this case, the height gained per turn (h) = $D_p = 21.33\text{mm}$

Total No. of turns that can fit on the drum or cylinder (n) = $\frac{D_d - D_c}{D_p}$

$$= \frac{450 - 260}{21.33} = 8.90$$

$$\therefore n' = 8$$

\therefore Total length of hose = $n' \times L_p$

$$\therefore L_p' = 23.93893\text{m}$$

Since $L_p > L_p'$, we will consider the maximum length of hose that can be wound on the drum as L_p .

RESULTS

From the theoretical calculation we got the specification for our project and this all theoretical result can satisfied our requirements. Following table shows the various result obtained from design calculation on the basis standard assumptions.

Table no. 1 Result table

Sr no.	Parameters	Dimension	Unit
1	Pipe	0.5	inch
2	Length of pipe	16	m
3	Inner diameter of the pipe	15.79	mm
4	Outer diameter of the pipe	21.33	mm
5	Wall thickness	2.76	mm
6	pipe length	50	feet
7	material of the reel will C-35	$\sigma_y = 360$	N/mm^2
8	Hollow cylinder thickness	2.5	mm
9	no of teeth on sprocket	12	
10	Inner diameter of reel D_c	260	mm
11	D_p = diameter of hose	21.33	mm
12	L_c = length of cylinder	185	mm

13	Outer diameter of reel D_R	450	mm
14	Inner diameter of pipe D_p	21.33	mm
15	Minimum thickness t	1.5	mm
16	L_s	150	mm
17	t_D	5	mm
18	C_A	1871.717	N
19	C_D	300	kgf
20	C	540	kgf

CONCLUSION

Thus using the obtained results of design calculations and specifications of various required components the roboreel can be successfully fabricated with least difficulty. The actual work to use roboreel can be initiated by gathering all the components as per design requirement and assembling them together. The objective to retract pipe automatically and reduce human effort has been successfully achieved.

REFERENCES

- [1] Anirudha V. Parlikar, Siddharth B. Gopujkar “Validation and Design of Critical Parameters of a Standard Hosereel”
- [2] Croll J. G. A.: Applied Ocean Research Volume: 22, Issue:4, August, 2000.

[3] URL:<http://engstandards.lanl.gov/esm/welding/vol2/WPF%202-04-Att-2-R1.pdf>

[4] URL:http://opus.ipfw.edu/etcs_seniorproj_mcetid

[5] P.S.G. Data Book.