Design and Fabrication of Roboreel

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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 wounded manually and kept properly. But when the pipe was unwounded 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.

Key words: Less Effort, Reduce Time

I. Problem Definition

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.

II. 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 an 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.

III. 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. Reel consists of a ratchet and pawl mechanism. It has a clock spring which is made of alloy steel.

A. *Components:*

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

IV. Theoretical Evaluation

- Selection of pipe
- Standard pipe material= rubber
- Half inch pipe
- 16m length

A. *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= $8 \times 21.33 = 170.64mm$

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),

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

$=\pi\times(260+21.33)\times8$

=7.07m

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.

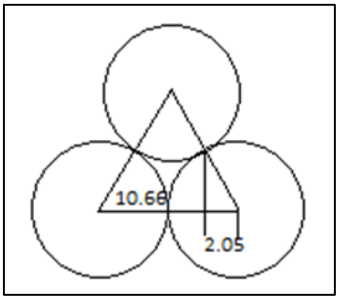

Fig. 1: Placement of adjacent layer of hose

Net height 'h' gained by next set of turns=10.66sin θ
Therefore,

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

cos θ=0.5478
$\theta = 56.78$
Therefore,
H=10.66sin 56.78
=8.91mm
Therefore,
$D_d = D_c + (2 \times H)$
=260 + (2×8.91)
=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.

$D_d - D_c$= Dp +$\frac{n}{2}$ × (h+Rp)
∴450-260 = $\frac{n}{2}$×(21.33+8.91+10.665)
∴n = 9.28
∴ Max 9set of turns are possible.
∴ Total length of hose = n×L_p
= 9×7.07
∴L_p= 63.63m

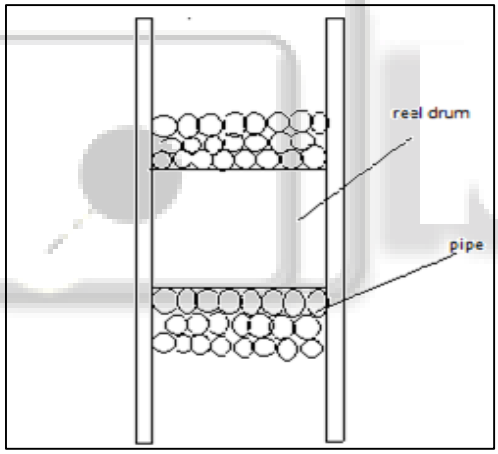

Fig. 2: Wounding of hose on hose on reel

(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 = 21.33mm
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
∴n'=8
∴Total length of hose=$n' \times l_p$
∴$L_P{}'$=23.93893m
Since L_P>$L_P{}'$, we will consider the maximum length of hose that can be wound on the drum as L_P.

V. Results and Discussions

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.

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	Lc =length of cylinder	185	mm
13	Outer diameter of reel D_d	450	mm
14	Inner diameter of pipe D_p	21.33	mm
15	Minimum thickness t	1.5	mm
16	Ls	150	mm
17	t_D	5	mm
18	C_A	1871.717	N
19	C_O	300	kgf
20	C	540	kgf

Table 1: Result table

VI. 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

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