Development of a Mechanical Push Lawn Mower with Double-Cylinder Spinning Blades

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Abstract

In this study, an innovative mechanical push lawn mower is designed. A prototype of the lawn mower is then constructed. The innovation is introduced by having a double-cylinder spinning blades driven by a chain and sprocket drive system. Since this is not powered by gas to operate, the device offers economic, environmental and health benefits. Field testing of the device shows that the efficiency of the double-cylinder blades increases considerably. That is, the number of passes to have a totally trimmed grass reduces doubly as compared to a single-cylinder blade. This device is ideal for cleaning and maintaining public and private lawns and gardens. It is worth noting that based on the performance of the device, the potential of its commercialization is very promising.

1. Introduction

Lawn mower is a mechanical device that uses revolving blades to cut a lawn at an even length [1]. Gas-powered lawn mowers are commonly used nowadays due to its high cutting efficiency, however, the operating cost is quiet high brought about by the skyrocketing cost of gasoline. Moreover, the noise produced during operation can cause considerable disturbance. And also, since gas is involved in this device, fumes or green house gases will be emitted to the environment, thus contributing to global warming [2, 3].

This study seeks to improvise the existing manual lawn mower with the main objective of improving the capacity and performance in trimming the lawn. Utilizing the concept of chain and sprocket mechanism as the drive system, a double-cylinder spinning blades is introduced into a mechanical push lawn mower. The two cylinder blades are of different height with respect to the ground. The first cylinder is used for initial cutting or for positioning the grass to the second blade with its desired height, the second cylinder for the last and final trimming. The cutting is performed by shearing action.

Aside from the opportunity to go green with lawn mowers, making it environmental friendly; it also offers health benefit in the form of exercise.

With this innovation, the performance and efficiency of a manual lawn mower is considerably improved. More importantly, with the utilization of locally available materials, the potential for its commercialization is very promising.

2. Methodology

2.1 Design

The two cylinder blades are designed in such a way that they are not of the same height with respect to the ground. The height of the first cylinder is 1.5 inches above the ground level and the height of the second one is 0.5 inch above the ground. The function of the first cylinder is for initial cutting or for positioning the grass to the second blade with its

desired height, the second cylinder for the last and final trimming.

The ratio of revolution used from the wheel to the cylinder is approximately 1:2. With this ratio, it is easy for the user to push the device. Basing on the principle of the bicycle's mechanism, the bigger the sprocket used, the lighter to push, though the speed of revolution is slow. However, it is stronger in force than the high-speed one especially that it`s not motor-driven. Figure 1 shows the three different sprockets used in coming up with the ratio of 1:2.

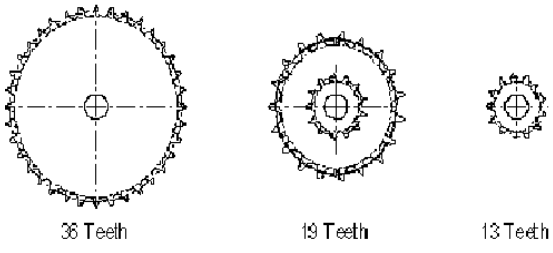

Figure 1. Three different sprockets used to come up with a 1:2 ratio

Figure 2 shows the design of the grass rotor or the helical cutting blades. In this study, the material used in fabricating the cutting blades is ordinary steel for financial reasons. In Figure 3, the schematic diagram of the chain and sprocket system is shown.

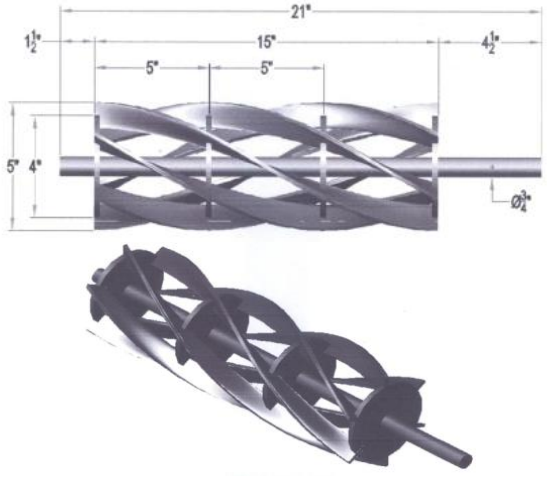

Figure 2. Design of the grass rotor (helical cutting blades)

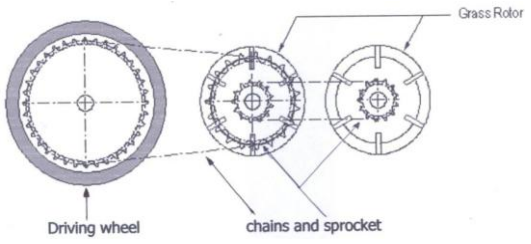

Figure 3. Schematic diagram of the chain and sprocket system

2.2 Prototype Development and Fine-Tuning

The equipment involved in the fabrication of this device are welding machine, lathe machine, milling machine and different bench tools. The materials necessary are sprockets, bearings, cold roll steel, G.I. pipe, bushings, 1/16" and 3/16" steel plate, angle bars and flat bars. After preparing and fabricating the different parts of the device such as the two cylinder of spinning blades, sprockets, shafts and frame or the body, all of the parts are then assembled. After assembly, the fixed blade is then mounted on it using the same metal with that of the blades in the cylinder. The fixed blade is mounted in tangent to the blade of the cylinder. Then the rear wheels are mounted at the back portion and serve as the balancer and the ones that determine the exact height needed. Then, the handle is welded in a position that could give comfortable handling.

The fabricated device is then carefully inspected. Oil is applied in all of its moving parts. The alignment of the chain and sprockets is also checked. Figure 4 shows the actual view of the prototype.

Figure 4. Actual views of the prototype

2.3 Field Testing

To evaluate the performance of the device, field testing is conducted. The performance of the double-cylinder blades is compared with a single-cylinder in terms of number of passes where the grass is totally trimmed. Testing is conducted in a lawn with carabao grass. Figure 5 shows the actual photos during testing.

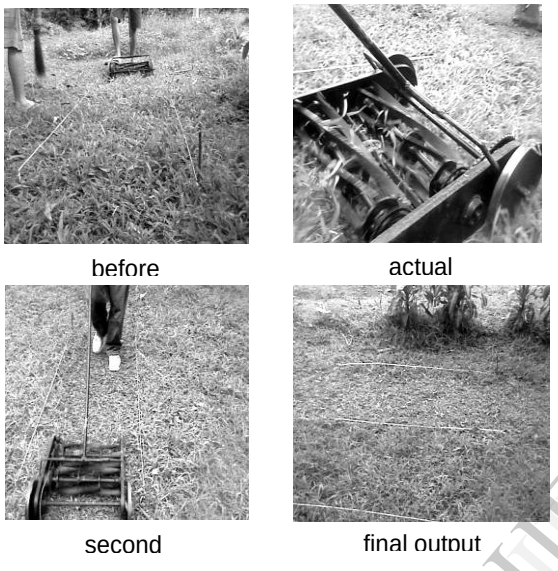

Figure 5. Actual photos during field testing of the device prototype

3. Results and Discussion

Table 1 shows the result of the performance evaluation of the lawn mower with double-cylinder spinning blades as compared to that with single-cylinder. As can be seen in the table, the efficiency of performance of the proposed device is almost double with that of a single-cylinder lawn mower.

It is observed that the grass is quite easy and faster to cut if it is short enough for the blades to shear. The reason why the two cylinders are of different height with respect to the ground is that there is a tendency that, if the grass is taller than cylinder, it will just cause the grass to bend down and will not get through the cutting space of the cylinder. The propose prototype is more effective if the height of the grass is not taller than the cylinder.

Table 1. Comparison of performance of manual lawn mower with single-cylinder and double-cylinder spinning blades

Trials	Length of Grass *(inches)*	Number of Passes *(Totally Trimmed)*	
		Single-Cylinder	Double-Cylinder
1	2-3	3	2
2	2-3	3	2
3	4-5	5	3
4	4-5	6	3
5	2-3	4	2

4. Conclusions

With this improvised manual lawn mower, it has been found that the performance and efficiency is considerably increased. The innovative device offers economic, environmental and health benefits. The device has a very promising potential for commercialization. To enhance further the potential and performance of the device, it is suggested to use tool steels for blades during production to minimize the need for sharpening. Also, the fixed horizontal blade that is installed in the device can be made adjustable as this blade determines the height of cut. Some minor changes are necessary such as the use of wheels with tire for easy pushing and maneuvering of the mower and the installation of guards for the chain and sprocket drive system. The design of the handle can also be improved for ease in operating the device.

5. References

[1] , D. G. Hessayon (2007) *The Lawn Expert*, Transworld Publishers, London.
[2] J. Heflin (2009), *Push Lawn Mowers: The Reel Deal*, The Valley Advocate.
[3] Mindfully.org (2001), Grass Cutting Beats Driving in Making Air Pollution.