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History of Lawn Mowers

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The History of Lawn Mowers

Honors Thesis

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ABSTRACT

A brief history of the lawn mower and the different innovations that developed over the years will be researched and discussed. This discussion will include the functionality of the different styles over the ages, especially the abilities of the powerful mowers of today. The research will then be utilized in the design of our commercial riding mower deck lift system for capstone, along with discovering other advancements that may be taken into consideration for future designs.

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INTRODUCTION

The first tool ever used to cut grass to a more desirable length was the scythe. The scythe has a simplistic design, containing a long wooden handle with a curved blade attached perpendicularly to the end. Until the 19th century, the scythe was the only option for cutting grass, which proved to be a long tedious process. The first actual mower was invented in 1830 by Edwin Beard Budding. Budding was an engineer from England who first discovered the idea of a mower from a cylindrical machine used for cutting in a mill. The mower that he developed was composed of a large roller which provided power to the cutting cylinder using gears. The cutting cylinder contained several blades connected in series around the cylinder. His innovation opened the door for numerous advancements in lawn cutting.

DEVELOPMENTS THROUGH THE YEARS

After Budding invented the first lawn mower, he created a partnership with John Ferrabee, a fellow English engineer. They obtained a patent in 1830 and were able to manufacture and sell the product. Along with the manufacturing of his own product, he licensed other companies, allowing them to produce the mower as well. Other companies were finally able to produce their own mowers in the 1850s when the patent was terminated. The first innovation in the lawn mower was created by Thomas Green in 1959. He produced the first chain driven mower, which was called the Silens Messor, meaning silent cutter. Since Green used chains to transmit power from the roller rather than gears, it allowed the mower to function in a more quiet manner.

Amariah Hills was the first American to obtain a patent for a mower design in 1868. During this time, horse drawn lawn mowers were most popular, although this posed a risk for the horses tearing up the

grass. Finally in 1870, Elwood McGuire designed a push mower that was much lighter with less mechanical movement. This design allowed the operator to easily push the mower rather than exerting as much energy as the older push mower designs required.

Although a lighter push mower had been designed, mowing grass proved to be an inconvenient and long task. Therefore, a non-man powered mower was desired. Resorting back to horse drawn mowers was not an option in order to keep a pristine lawn and resulted in the next big innovation of motorized mowers. In the 1890s, steam powered engines were commonly used, but the time it took to fire it up became even more of an issue which created the desire for an engine that utilizes a different source of energy. In 1902, Ransomes, Sims, and Jefferies introduced the first internal combustion gasoline powered engine. The United States was finally able to manufacture gasoline powered mowers in 1919 thanks to Colonel Edwin George. Although these engine powered mowers were available, they were rarely used in households due to the economic problems of the time.

In the 1920s and 1930s the electric powered mower, along with rotary cutting, were created but did not become popular until considerably later. Throughout the 1940s the only innovations were developing smaller, lighter weight designs along with more powerful engines. In the 1960s, the designs were now being produced in plastic materials to further reduce the weight and cost.

CURRENT MOWER DESIGNS AND ACCESSORIES

Current lawn mowing includes a multitude of applications and each of these applications include different types of technologies. Some are completely electric, some are hybrid, but like the prominent

driving vehicles, the most popular lawn mowers are gasoline driven. Even though one may have an engine being gas powered, the deck lifting system may be mechanical, electrical, hydraulic, or even a combination. Essentially, three main types of mowers exist today, walk-behind, riding and tow-behind mowers.

Walk-behind mowers were the first invented and by far the simplest. A picture of one of the most up to date walk-behind mowers can be found in the Appendix, Figure e. The main problem of a walk-behind mower is that the amount of lawn mowed is extremely small compared to that of the other two types of mowers. Not to mention one must literally walk behind it for the duration of the lawn mowing, which could be hours or even days. Walk-behind mowers can be completely mechanical, like the first lawn mowers, gasoline powered or even electrically powered. The mechanical ones are a little out of date, mostly because of the force required to push one a considerable distance. Electrically powered ones are currently taking the lead because of the demand for gasoline. For decent to large sized lawns these walk-behind mowers are just not recommended.

Riding mowers are much more complex. An operator is riding on the actual mower, which is ran by a much larger engine than in the walk-behinds. They can be much larger than walk-behinds and can move faster and for a longer period of time, considering an operator would need a break after a little time using a walk-behind. For a visual concept of a riding mower, the Dixie Chopper Silver Eagle 2550 can be found in the Appendix as figure f. Riding mowers use much more energy and deciding between an gasoline powered or electrically powered mower can be a tough decision. If trying to protect the environment, one would most definitely pick electrical, but currently the technology behind a gasoline powered mower surpasses that of an electrical one. Because of the technological advantage and the fact

that gasoline powered mowers are considerably cheaper, keeps gas powered mowers on top. Riding mowers can be used anywhere from a small lawn to a large field. They are the most versatile. If the lawn is too small and hard for the riding mower to cut corners and such, than a walk-behind would be suggested. In relation to the counterpart, if the lawn is too big, and would take the riding mower an undesired amount of time to mow it, then a tow-behind mowers may be advised.

Tow-behind mowers are used for much larger areas, like massive fields, and are used much more in agriculture and road sides. Tractors or powerful vehicles must tow these devices. Most are mechanical, much like some of the first lawn mowers ever invented. They use the rotation and energy from being pulled over ground to rotate and cut grass, sod or whatever needs to be cut.

Automated mowers, to the point where you just turn them on and they mow your entire lawn without any assistance, exist. Automated mowers are expensive and issue prone, but could be the future of mowing. The cheapest and most efficient would be mechanical because under a mechanical system there is no initial energy needed besides the operator's force. However, certain movements, the weight of the deck, and many other variables make the mechanical lift much harder to design.

DIXIE CHOPPER CAPSTONE DESIGN

Dixie Chopper, a commercial mower company, contacted University of South Florida for assistance in developing a new design from some fresh engineering minds in senior capstone. Team Rambo was the capstone group that chose to take on the Dixie Chopper project. They were assigned to create a new unique design for the deck lift system of their Silver Eagle series 2550 commercial mower. After much

discussion with the lead engineers, along with the personal observation of the mower, three specific problems were discovered.

The first issue was the amount of force needed to lift and lower the deck. The deck is the system of the mower that contains all the pulleys and blades needed in order to cut the grass which includes a steel covering for protection. Because of all the different heavy duty components, the deck itself is about 200 pounds. The force that must be applied to the lever in order to lift the deck was calculated to be about 80 pounds. Although this is less than half the actual weight, compared to other mowers from their competitors it was extremely difficult to actually lift. In the deck lift system there are two sets of compression springs in order to lessen the needed lifting force. The springs bend out of the desired line of motion which causes loss of force in the horizontal direction. The final problem was with the quick lift system. The purpose of the quick lift system is to swiftly lift the deck in case an obstacle, such as a stump, is in the way while mowing. When the quick lift is applied, the height adjustment handle that stops when it reaches the stopping plate tends to get stuck on the different height notches when it is released back down and causes the quick lift system to work incorrectly.

After discovering these problems, Team Rambo applied two goals they would like to achieve in order to make a more efficient design for the Dixie Chopper customers. The first goal was to discover a new way to assist the lift instead of the compression spring and reduce the necessary force to about 20 pounds. Using springs are extremely common in manual deck lift systems. Therefore, Team Rambo wanted to think outside of the box and produce an innovated idea. After debating using a constant force spring, they finally found a gas spring that is able to self-lock when the deck is lifted to the largest height. In

utilizing the gas spring and extending the arms of the attached link, they were able to reduce the force to about 22 pounds. The subtle change affected the design tremendously.

The second goal Team Rambo applied was to adjust the quick lift system to eliminate the current problems. The height adjustment system consists of a long hexagonal rod that has several notches in which the stop plate fits into along with a hand lever that is made to stay in place when it reaches the stop plate. The notches correspond to the different height levels at which the deck can be set. In the "quick lift" feature you apply a force to the foot lever until it reaches the maximum height. Once it reaches this height, then the hand lever falls into the last notch in order to stay in the upright position to safely drive over the obstacle. The operation has no problems, but once the lever is released to drop the deck back to the desired height, the lever will get stuck on the other notches. To eliminate this problem, Team Rambo completely removed the lever. Since the gas spring used contains a self-locking system, the last notch for the quick lift height was no longer necessary, causing the lever to no longer be a necessity. Instead, a rigid connection was made in order to stop the deck at the applied height.

POSSIBLE FUTURE ADVANCEMENTS

As technology improves so does possibilities of improvements towards anything from silverware to quantum computers. Although the final design may not have been perfect, it solved more issues than it created. Larger steps could be taken from this design to perfect it, but from discussing lawn mowing innovations with Stephen Hill of a prestigious lawn maintenance company, IMAGE MAKER, it seemed the next big thing should be a large bladed, ride along mower which would be able to lift and rotate the entire deck 90 degrees to get through an assortment of gates and gaps in front of large lawns. The new

innovation would diminish the time to cut the lawn tremendously, because some lawns have small gates in front them and without a rotating deck, the largest blade you can use is the size of the opening in the gate. The only downfall of the feat is that it will take much more designing and will probably be quite costly when originally invented.

As for the changes that can be or should be done to the specific design, some aesthetics can be implemented into the design. However, material decision and spring constant decision testing must be done to determine the best material and spring constant. Another idea that could be executed is an electrically powered lift system which would draw more power from the battery, however while being powered from the motor this power shouldn't effect anything. Sentence doesn't make sense to me and I don't know how to reword it. An electrical system would be much smoother, require virtually no force from the operator, and be more accurate. Ball-bearings in the links could also reduce friction and increase the life of many components on the mower. Alternative materials to reduce mower deck weight could make lifting it much easier and less straining on parts, which could also increase life of components.

CONCLUSION

Lawn mowers are an important part to many different places throughout the world. The role they play in agriculture and aesthetics of so many different types of lawns is much more important than people realize. Even a seemingly small industry, like lawn mowing, has so much development and designing that it becomes a prestigious art to some. Many people do not understand how much work and thought is put in to the smallest of things. Lawn mowers can be as complex as a street legal vehicle, and even more

expensive than some. However, in a quite some years, many believe lawn mowing will be much more automated, if not completely automated in many areas.

Working diligently on designing just certain parts of the mower has proven to be extremely difficult. So many aspects are brought into the engineering problem, like material life, environment, user interface, and functionality. While components may seem simplistic, there is always a reason why it is utilized throughout the mower which is why acknowledging the past mower designs greatly assisted Team Rambo in designing and perfecting the 2550 Silver Eagle!

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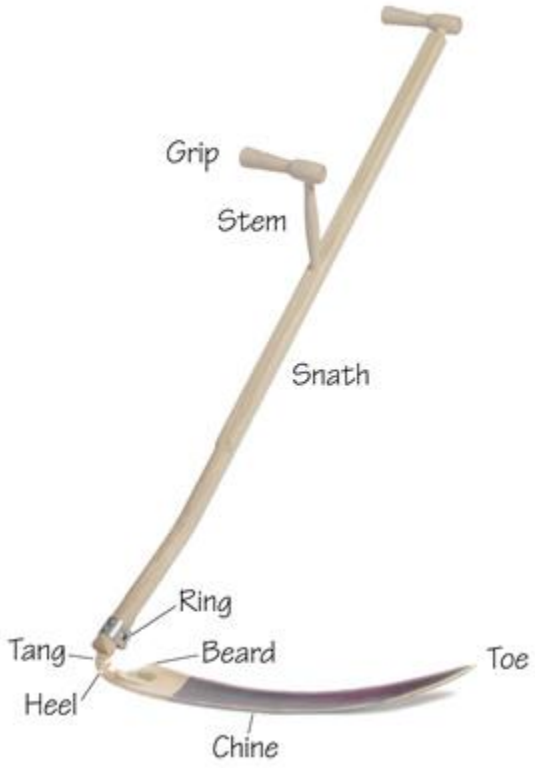
APPENDIX



a. Figure 1: Scythe design

b. Figure 2: First Lawn Mower Design Created by Budding

c. Figure 3: Silens Messor

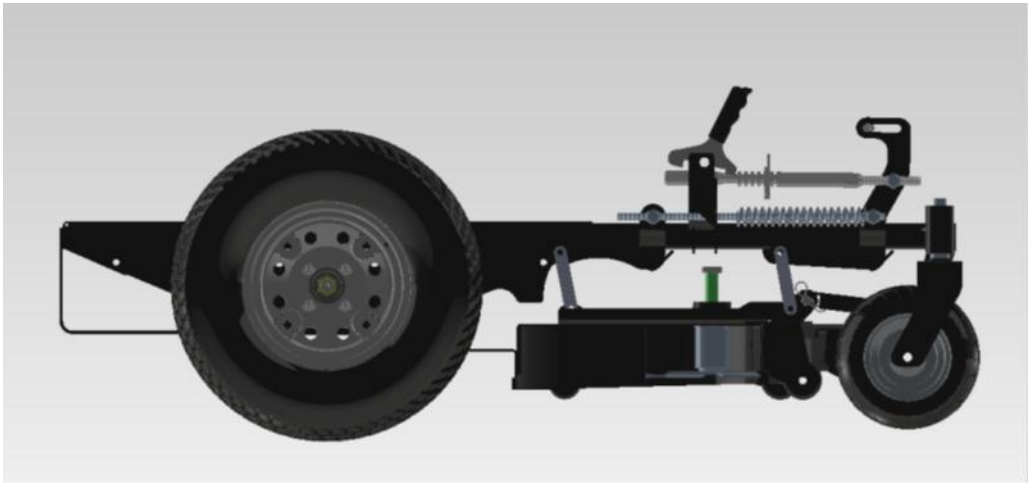
d. Figure 4: Horse Drawn Mower from the mid 1800

e. Figure 5: Ransomes, Sims & Jefferies Engine Powered Mower

f. Figure 6: Walk-behind mower, the Toro Cordless Lawn Mower

g. Figure 7: Riding mower, Dixie Chopper Silver Eagle 2550

h. Figure 8: Tow-behind mower (does not move on its own, needs to be pulled)



i. Figure 9: Original Dixie Chopper Silver Eagle 2550 SolidWorks deck lift model

j. Figure 10: Final Design of Dixie Chopper Silver Eagle 2550 with adjustments