POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

DEPARTMENT OF MECHANICAL ENGINEERING

THE BLACK INFERNO PITCHING MACHINE

NAMA :	MATRIX NUMBER:
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This report is submitted to Department of Mechanical Engineering as fulfilled some of the condition to be awarded Diploma in Mechanical Engineering

DEPARTMENT OF MECHANICAL ENGINEERING

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ACKNOWLEDGMENT

The completion of this research would not be possible without the material and moral support from various person. It is our responsibility therefore to extend our gratitude to them. First of all, we thank the Almighty God, Allah, for giving us a healthy living and guide us through the entire course. We are deeply thankful to Dr. Siti Khalijah binti Jamal who was our supervisor and Dr. Mohd Elias bin Daud from Politeknik Sultan Salahuddin Abdul Aziz Shah, Shah Alam, Selangor, Malaysia for her active supervision, dedication, availability and professional advice. Our appreciation finally goes to our classmates, with whom I weathered through the storms, giving each other encouragement and for their positive criticism.

ABSTRACT

Pitching machine is widely used in venues ranging from professional baseball stadiums to batting centers. However, the throw performance of the pitching machines that have been developed so far for use during batting practice is not very high. Pitches such as the fastball, curveball and screwball are easily achieved by the pitching machine with three rollers which were developed by the authors. In this study, the moving behavior and contact stress state of the ball pitched with the three rollers type pitching machine is analyzed using dynamic finite element analysis software (ANSYS/LSDYNA). The effect of the seam of a baseball to the throw accuracy is analyzed numerically. In the analysis, the finite element models of a detailed baseball with a seam and a pitching machine with three rollers are used. Additionally, convex and concave rollers are made and those are analyzed. From the analytical results, it is understood that the convex roller is higher than other rollers in throw accuracy. The convex roller geometry is optimized, and the optimum conditions (shapes and material properties) of the convex roller are decided. Moreover, the validity of the condition is confirmed by the throw experiment.

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CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

The Inferno Pitching Machine was designed to give you extra hitting time between your practices & games and is perfect for the travel team that does not want to haul a heavy motorized machine. Its light weight makes it extremely portable and no electricity is required. This is a great pitching machine that player of all levels can use. The Inferno is the most affordable real-baseball throwing machine that we have ever tested and can throw a few type of ball. It will throw a ball from 35 feet at speeds from 18 mph to the 40-43 mph Inferno Pitching Machine range. It can throw a consistent 10 to 12 foot arch ball slow pitch. The Inferno can be used for baseball, softball, cricket, and tennis. This makes it a truly one-stop pitching and training solution for players and coaches alike. You can use plastic, dimpled, hard and soft balls with The Inferno.

1.2 PROBLEM STATEMENT

When pitcher cricket and baseball practice they have to perform repeated activities, for example when throwing a lot of balls over and over again, the player becomes tired. Also, pitcher not only throw the ball a lot but they have to throw hard. So they were exposed to injury. When they are injured, they will interfere with the team's tactics. Besides, some teams are financially good and some are not. Teams that have good finances can afford to pay for electricity to use electric pitching machines. This machine uses a lot of electricity. So how about a team that is less financially, they can't afford it

1.3 OBJECTIVE

1. Easy to handle because it does not require much energy.
2. Throw the balls repetitively towards the batsman
3. Ball travel at constant speed.

1.4 RESEARCH QUESTION

This study will answer the following research questions:

1. Can the machine throw the ball with high speed and accurately?
2. Can the machine help players training easily?

1.5 SCOPE

1. This product to facilitate amateur player.
2. This product is specially designed to throw similar size of ball like tennis, baseball sizes.
3. No electric energy used.
4. Adjustable.

1.6 IMPORTANCE

Pitching machines are a training aid designed to permit players to practice, hone, and refine their batting stroke without requiring the presence of a pitcher, or otherwise requiring a catcher to receive the batting practice pitches. Pitching machines are similar in their purpose to the simulators used in other sports, such as computer-supported bobsled trainers. The pitching machine is more limited in its application than some other sports simulators because the athlete is focused on one narrow aspect of baseball training in facing pitches thrown by the machine. The pitching machine does not require the athlete to engage in the entire sport skill set as would be required in an actual competition.

1.7 CHAPTER SUMMARY

From the research we have done, know we now what is pitching machine function and all of the design that have been created nowadays. We are now got an idea to making what is our product. We also know the needed of the pitching machine users and all of the details which is problem that they have faced when using bare hand to pitch and electric machine. So from there, we are now trying to build up a project or a product which can used and helping the players.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter provides the detail description of literature review done according to the project of "Black Inferno Pitching Machine ". Since the aim is to design a machine that could help pitcher will running on efficiency. This literature review will give an overview or a brief introduction of the techniques that are suitable to be used in this project.

2.2 CONCEPT OF DESIGN

BLACK INFERNO PITCHING MACHINE

Black inferno pitching machine is a machine used to helps batters and coaches enjoy a more successful batting practice or coach-pitch game. We will apply the concept of the design. Plus, it saves the coach's arm. Because the lever action flicks baseballs with consistent speed and location, it's often used as an alternative in coach-pitch leagues to help overcome the fear factor of live pitching. Young hitters will know where and when the ball will be pitched. A pitching machine is a machine that automatically pitches a baseball to a batter at different speeds and styles. Most machines are hand-fed, but there are some that automatically feed. There are multiple types of pitching machines; softball, baseball, youth, adult, and a combination of both softball, cricket and baseball.

2.3 LITERATURE REVIEW – PITCHING MACHINE

2.3.1 2PITCH4 BASEBALL PITCHING MACHINE THE BATA 2PITCH4

2pitch4 Baseball Pitching Machine. The BATA 2Pitch4 Baseball throwing machine is simply the best throwing machine made! Maximum hasten on each head. This allows you to adjust the races to any setting with any rotate. Each head is adept of throwing any pitch that a genuine pitcher can hurl. These baseball pitching machine are the only machines that use Unique Goodyear Rubber supple Trend throwing wheels. The supple tread wheels are solid, die cast, flat faced rubber treads, molded and vulcanized up on a machined aluminum core.

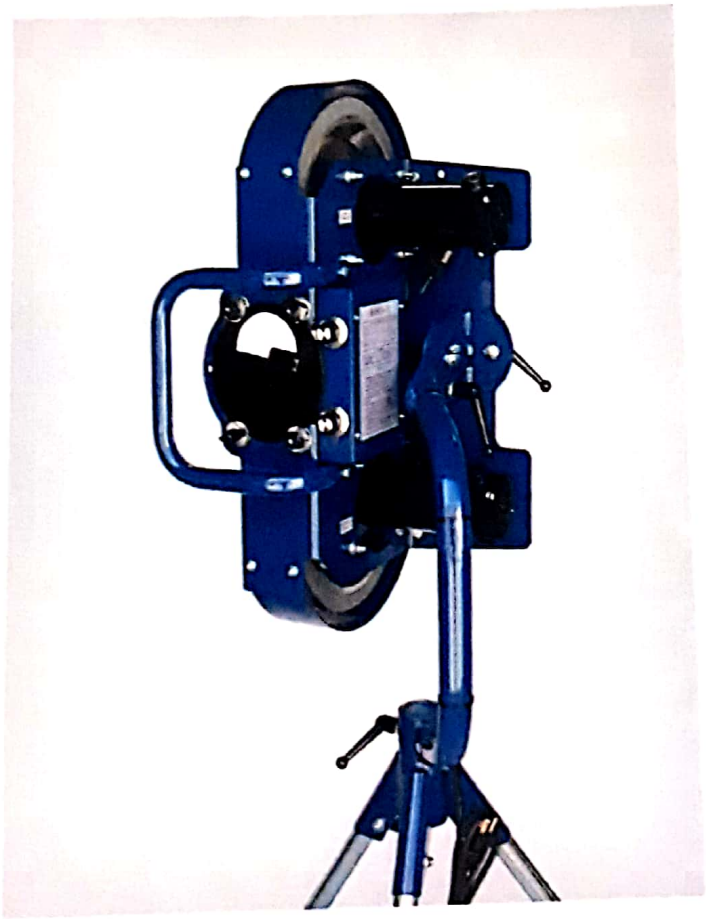


FIGURE 2.1

2.3.2 HEATER SPORTS BASEBALL PITCHING MACHINE

The Heater machine comes with a stand-out design, making it look like a futuristic laser beam, which adds a certain cool factor to the machine. That is not to say that the machine scores any less in terms of performance. Instead, the machine comes with a wide range of pitching tools and options which makes it perfect for baseball and softball practice sessions. The height of this pitching machine can also be tweaked and adjusted. This means that apart from throwing level pitches, the machine can also be used to pitch grounders and fly-balls. As a result, you can use this machine for defense practice as well.

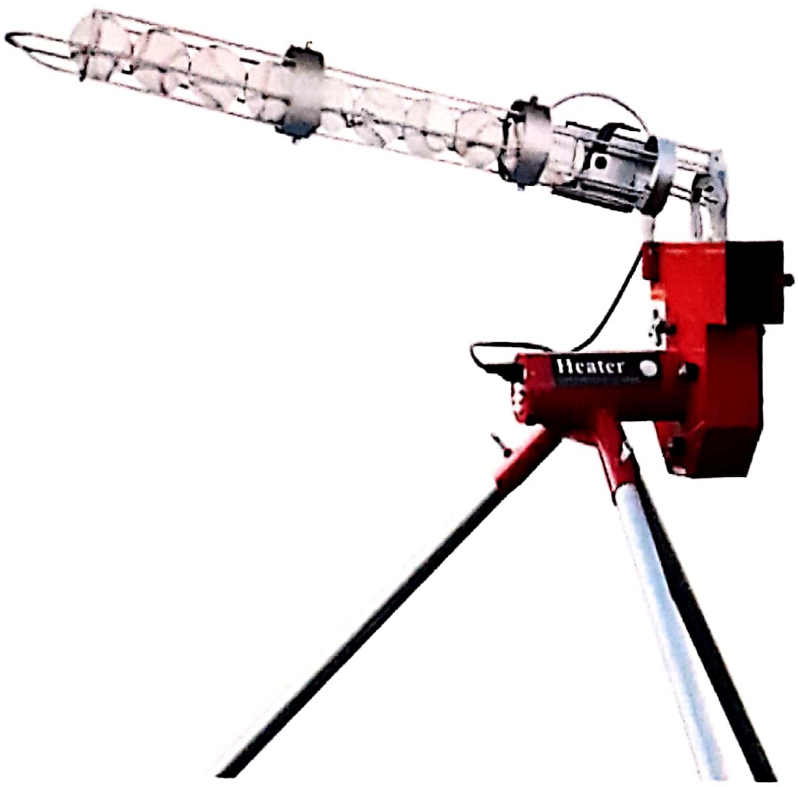


FIGURE 2.2

2.3.3 SPORTS ATTACK JUNIOR HACK ATTACK BASEBALL PITCHING MACHINE

The Junior Hack Attack Baseball Pitching Machine from sports attack is a great pitching machine for any leagues, from youth all the way up to professional players. It has a unique three-wheel design that allows players to not only work on their pitching but also to learn the process of accelerating and releasing the ball, just like with a real pitcher. Moving the Junior Hack Attack on and off the field is easy – just tilt, un-socket the legs, and roll it on the transporting wheels. It weighs roughly 75 pounds but is fairly compact and can fit in the trunk of most cars. You can use softer practice balls with this machine, but synthetic rubber balls should be avoided as they will leave residue on the wheel and eventually start to affect accuracy.

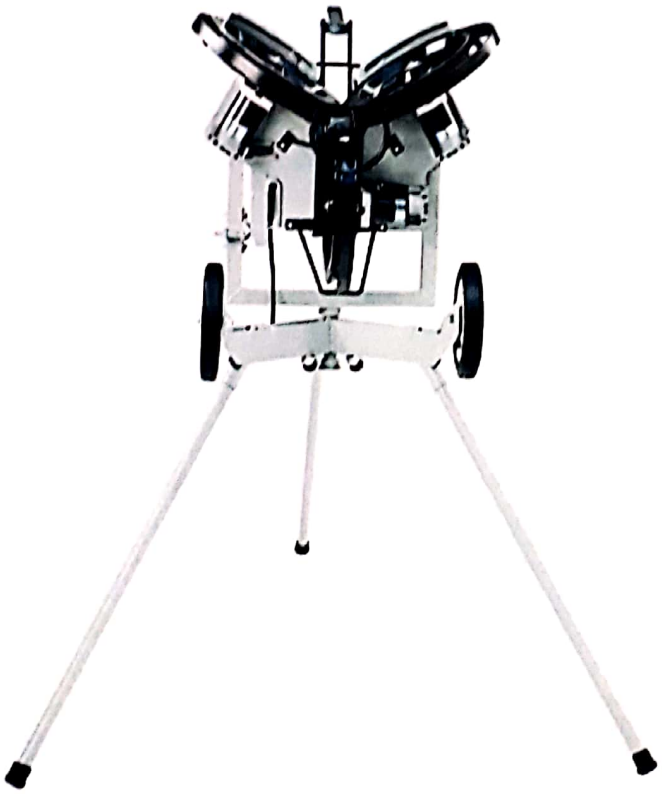


FIGURE 2.3

2.3.4 JUGS LITE-FLITE WORKS WITH BASEBALLS AND SOFTBALLS

The Jugs Lite-Flite works with baseballs or softballs, has a wide range of movement, and can be easily adjusted to throw sliders, curveballs, and fastballs. Its simple design is easy to operate and it swivels a full 360 degrees which makes it perfect for simulating pop flies and hard ground balls. This makes this pitching machine a great choice to practice both hitting and fielding. One great feature is it can be adapted to throw both left and right-handed pitchers. Left-handed pitchers throw the ball completely different than right-handed pitchers. This machine will really help you or your ballplayer prepare for anything. With Jugs Lite-Flite Pitching Machine, the ball is always in view which lets the hitter work on timing and ball position as well as swinging. There's a quick change mechanism so it's quick and easy to change the settings from baseball to softball. In addition to being so versatile, this pitching machine is exceptionally portable.

FIGURE 2.4

PREPARED BY: MUHAMMAD FAKHRUL HAZZIM BIN MOHD HAFIZ
(08DKM17F1231)

2.4 LITERATURE REVIEW – SPRING

2.4.1 WHAT IS SPRING?

A spring is an elastic object that stores mechanical energy. Springs are typically made of spring steel. There are many spring designs. In everyday use, the term often refers to coil springs. When a conventional spring, without stiffness variability features, is compressed or stretched from its resting position, it exerts an opposing force approximately proportional to its change in length (this approximation breaks down for larger deflections). The rate or spring constant of a spring is the change in the force it exerts, divided by the change in deflection of the spring. That is, it is the gradient of the force versus deflection curve. An extension or compression spring's rate is expressed in units of force divided by distance, for example or N/m. A torsion spring is a spring that works by twisting; when it is twisted about its axis by an angle, it produces a torque proportional to the angle. A torsion spring's rate is in units of torque divided by angle, such as Nm/rad degree. The inverse of spring rate is compliance, that is: if a spring has a rate of 10 N/mm, it has a compliance of 0.1 mm/N. The stiffness (or rate) of springs in parallel is additive, as is the compliance of springs in series. Springs are made from a variety of elastic materials, the most common being spring steel. Small springs can be wound from pre-hardened stock, while larger ones are made from annealed steel and hardened after fabrication. Some non-ferrous metals are also used including phosphor bronze and titanium for parts requiring corrosion resistance and beryllium copper for springs carrying electrical current (because of its low electrical resistance).

2.4.2 TYPES OF SPRING

TORSION SPRING

A torsion spring is a spring that works by twisting its end along its axis; that is, a flexible elastic object that stores mechanical energy when it is twisted. When it is twisted, it exerts a force (actually torque) in the opposite direction, proportional to the amount (angle) it is twisted.

FIGURE 2.5

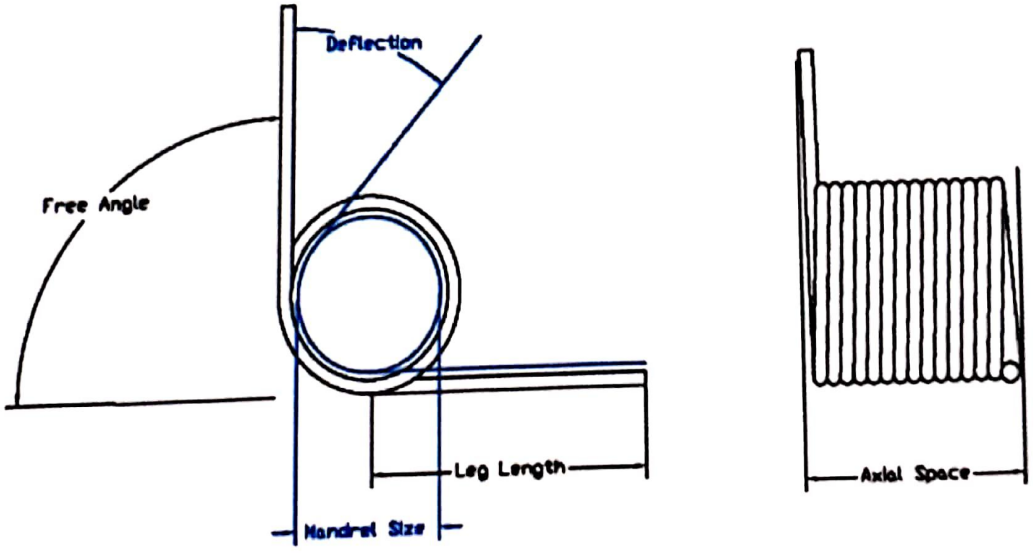


FIGURE 2.6

EXTENSION SPRING

Extension Springs are springs which absorb and store energy by offering resistance to a pulling force. Typically, extension springs are made from round wire and are close wound with initial tension. Extension applications include tape cassette players, balance scales, garage doors, washing machines and applications which requiring various types of tensioning devices. Various types of ends are used to attach the extension spring to the source of the force.

FIGURE 2.7

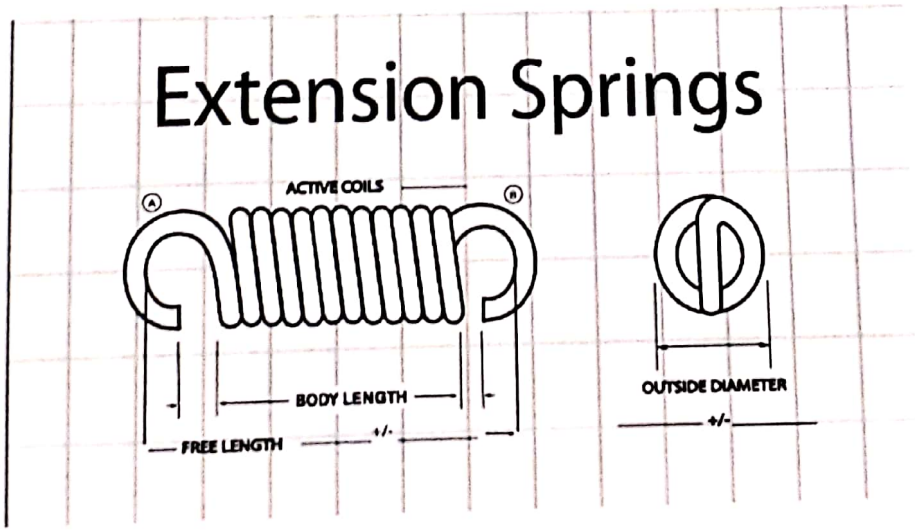


FIGURE 2.8

COMPRESSION SPRING

Compression springs are open-coiled springs which are wound in a helical shape. They are designed to oppose compression, meaning they can push back when they are pushed on. Helically-wound compression springs are the most common configuration and have an extensive range of uses. Compression springs are typically positioned over a rod or fitted into a hole. When the spring is subject to pressure caused by weight pressing on its axis, it compresses and becomes shorter. As the spring compresses, it gains a potential to push back in an effort to return to its original position.

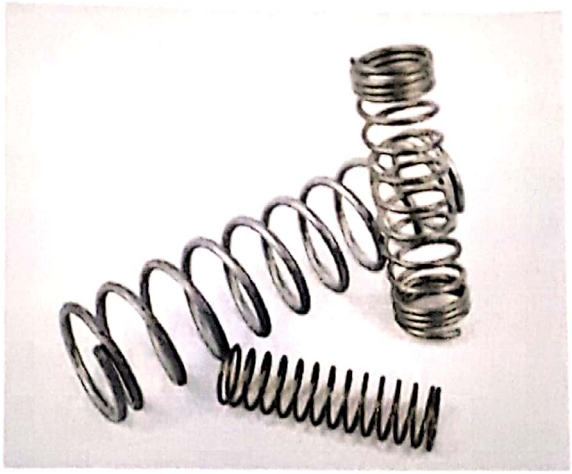


FIGURE 2.9

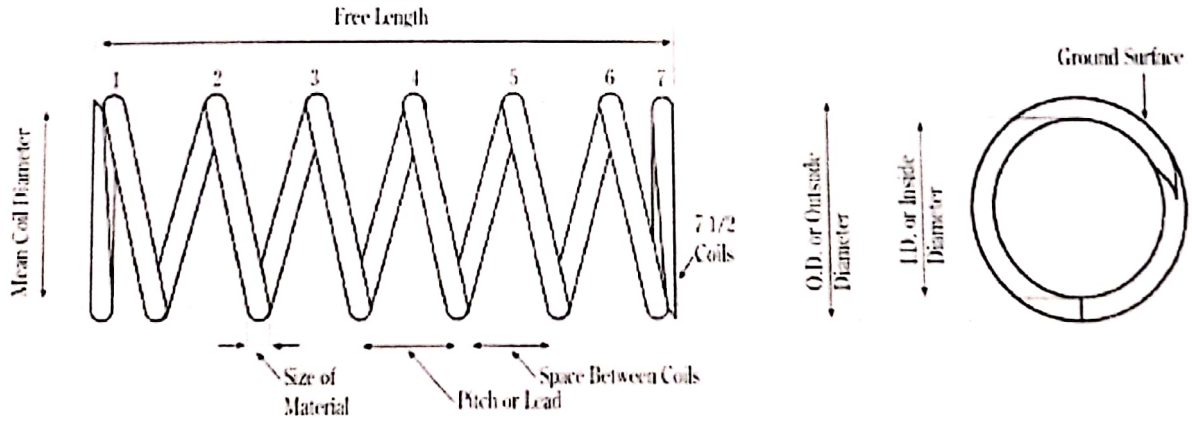


FIGURE 2.10

2.5 LITERATURE REVIEW – BALL

2.5.1 CRICKET

A cricket ball is a hard, solid ball used to play cricket. A cricket ball consists of a cork core wound with string then a leather cover stitched on, and manufacture is regulated by cricket law at first-class level. The trajectory of a cricket ball when bowled, through movement in the air, and off the ground, is influenced by the action of the bowler and the condition of the ball and the pitch, while working on the cricket ball to obtain optimum condition is a key role of the fielding side. The principal method through which the batsman scores runs is by hitting the ball, with the bat, into a position where it would be safe to take a run, or by directing the ball through or over the boundary. Cricket balls are harder and heavier than baseballs. In day test cricket, professional domestic games that spread over a multitude of days, and almost the entirety of amateur cricket, the traditional red cricket ball is normally used. In many one day cricket matches, a white ball is used instead in order to remain visible under floodlights, and since 2010, pink has been introduced to contrast with players' white clothing and for improved night visibility during day/night Test matches. Training balls of white, red and pink are also common, and tennis balls and other similar-sized balls can be used for training or informal cricket matches. During cricket matches, the quality of the ball changes to a point where it is no longer usable, and during this decline its properties alter and thus can influence the match. Altering the state of the cricket ball outside the permitted manners designated in the rules of cricket is prohibited during a match, and so-called "ball tampering" has resulted in numerous controversies.

2.5.2 TYPES OF CRICKET BALLS

FIGURE 2.11

2.5.3 TYPES OF PLASTIC BALLS & TENNIS BALLS

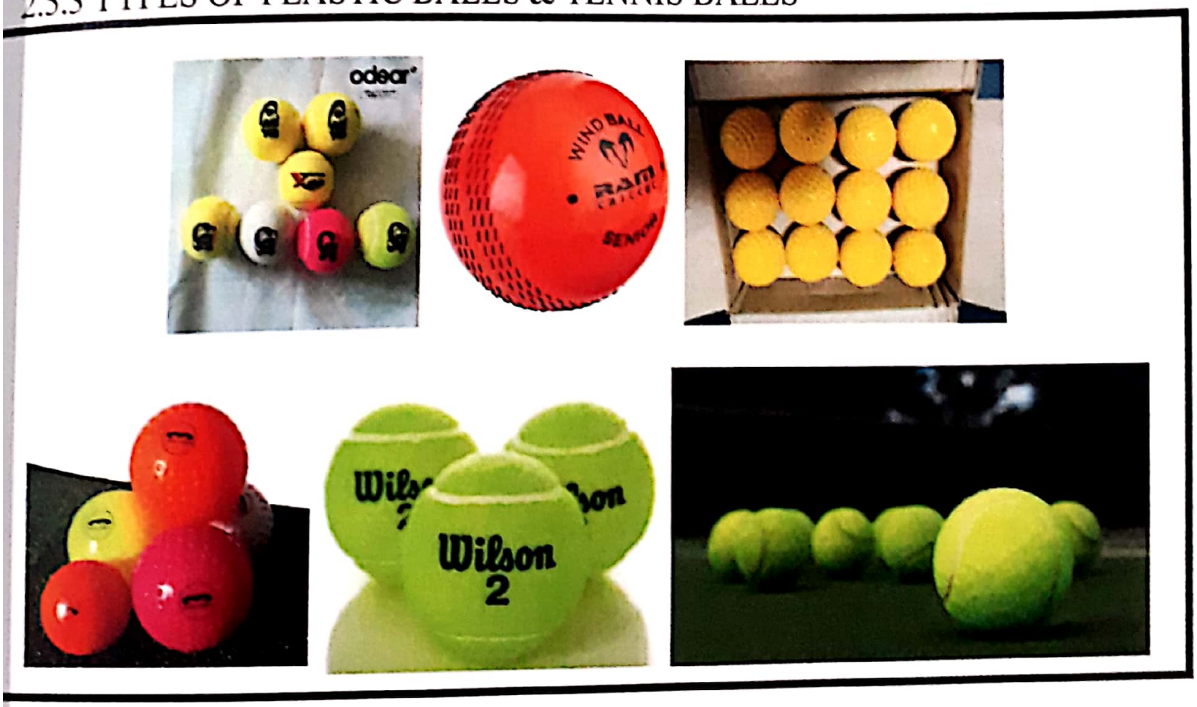


FIGURE 2.12

2.5.4 BASEBALL

A baseball is used in the sport of the same name. The ball features a rubber or cork center, wrapped in yarn, and covered, in the words of the Official Baseball Rules "with two strips of white horsehide or cowhide, tightly stitched together". It is 9–9 1⁄4 inches (229–235 mm) in circumference (2 55⁄64–2 15⁄16 in. or 73–75 mm in diameter), with a mass of 5 to 5 1⁄4 oz. (142 to 149 g). The yarn or string used to wrap the baseball can be up to one mile (1.6 km) in length. Some are wrapped in a plastic-like covering. A significant quality of the baseball is the stitching that holds together the covering of the ball. After a ball has been pitched, these raised stitches catch the air and cause the ball to swerve slightly on its way to the catcher. Whether the ball swerves to the right, to the left, downward, or a combination thereof, and whether it swerves sharply or gradually, depends on which direction, and how fast, the stitches have been made to spin by the pitcher. See, for example, curveball, slider, two-seam fastball, four-seam fastball, sinker and cutter.

2.5.5 TYPES OF BASEBALL BALLS

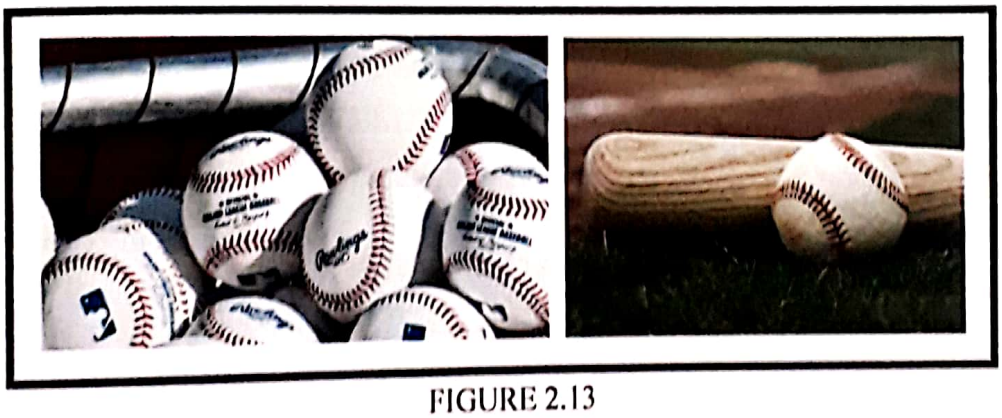


FIGURE 2.13

CHAPTER 3 METHODOLOGY

3.1 INTRODUCTION

Methodology can be an analysis of the principles and rules that serve discipline, systematic study on methods that can or have been used in discipline or a particular procedure or set of procedures. Methodology includes a collection of coherent philosophies of the theory, concept or idea as it relates to a field or field of inquiry. Methodology is also a method and technic in designing, collect and analyze data for the project proving that can support a project. It also explain a problem analysis and cause of a certain method and technic is used. Purpose of methodology is to help in understanding more detail about the application method with the explanation of the research process.

PREPARED BY: VIMALLAN PALANIANDY (08DKM17F1243)

3.2 METHODOLOGY FLOW CHART

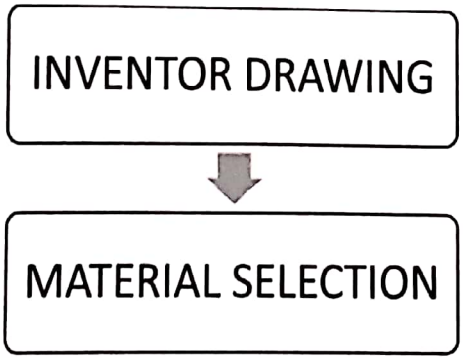


CHART 3.1

3.2.1 INVENTOR DRAWING

The design of a pitching machine affects its efficiency and reliability. It is, therefore, necessary to find a pitching machine whose design suits your needs. Therefore we came up with this design. This Pitching Machines are made commonly of steels and with springs that helps this design of pitching machines of being able to adjust speed and pitch direction to suit your needs.These machines provide players with excellent accuracy, superior precision, the ability to throw different pitch types and fast speeds.

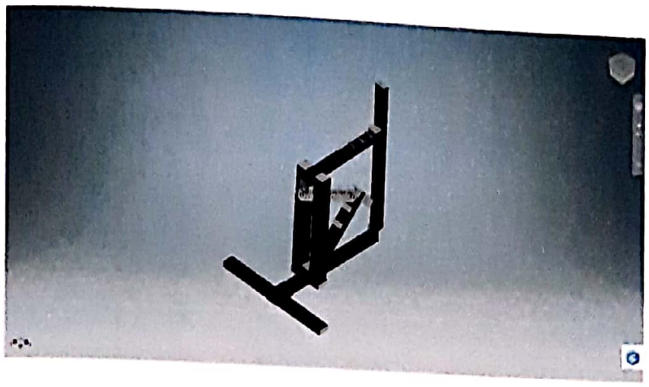
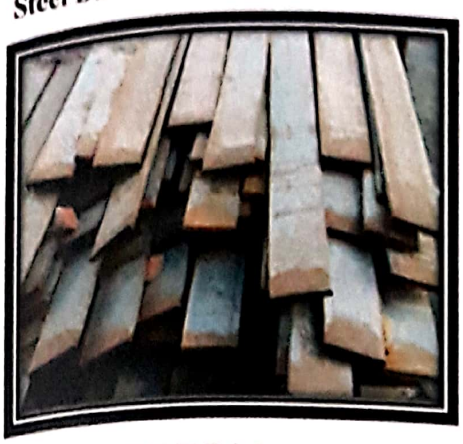
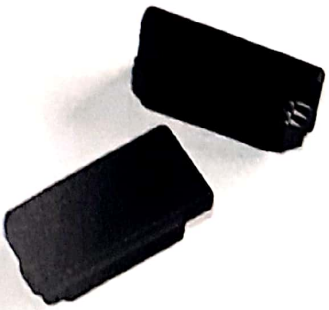


FIGURE 3.1

3.2.2 MATERIAL SELECTION

The scope of this Material Selection is to select suitable materials for this pitching machine to have a sustainable material. Besides that, the main goal of material selection is to minimize cost while meeting product performance goals.

Material	Cost
1. Hollow Steel  FIGURE 3.2	Price: RM 3.50/kg Budget needed: 10kg x RM 3.50 = RM 35.00
2. C Channel Steel  FIGURE 3.3	Price : RM 3.00/kg Budget needed: 10kg x RM 3.00 = RM 30.00
3. Extension Spring  FIGURE 3.4	Price :RM 60.00/unit

4. **Steel Bar**  FIGURE 3.5	**Price : RM 3.00/kg** **Budget needed : 10kg x RM 3.00** **= RM 30.00**
5. **Base Tube Cap**  FIGURE 3.6	**Price : RM 1.00** **Budget needed : 3 kg x RM 1.00** **=RM 3.00**
6. **Screw Pin**  FIGURE 3.7	**Price : RM 1.00** **Budget needed : 2 kg x RM 1.00** **= RM 2.00**

7. Bolt  FIGURE 3.8	Price :RM 2.00 Budget needed : 2 kg x RM 1.00 = RM 2.00

TABLE 3.2.2

3.3 METHODOLOGY FLOW CHART

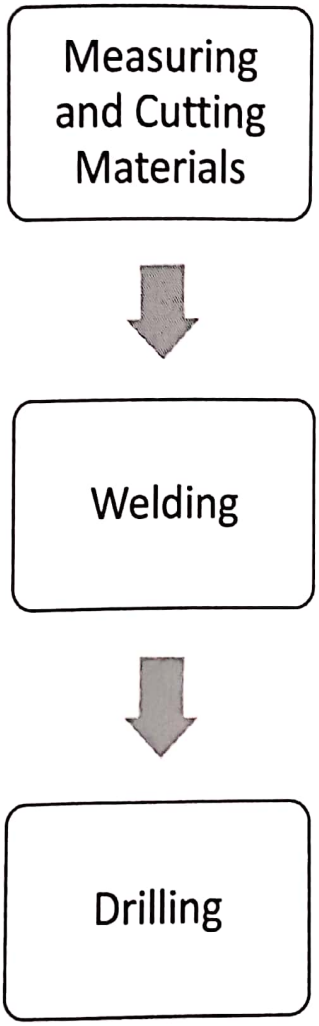


CHART 3.2

3.3.1 MEASURING AND CUTTING MATERIALS

On this project, we need 11 steel parts. The following steel are the trigger part, the base, the T joints base for the front project, two parts for the launcher, two parts for the launcher holder, the paddle, the socket for the launcher and the trigger holder, and the plate to be fitted with the paddle. Below is the measurement of required:

1. TRIGGER
    - Used 2in x 1in hollow steel.
    - Length: 2.5ft (0.762m).

2. BASE
    - Used 3in x 1.5in hollow steel.
    - Length: 2.0ft (0.61m).

3. T JOINTS BASE
    - Have two parts :
        - Part 1: Used 3in x 1.5in hollow steel. Length: 1ft (0.3m).
        - Part 2: Used 2.8in x 1.3in hollow steel. Length: 4in (0.102m).

4. LAUNCHER
    - Have two parts :
        - Part 1: Used 3in x 1.5in hollow steel. Length: 0.8ft (0.24m).
        - Part 2: Used 2In x 1in hollow steel. Length: 1.5ft (0.46m).

5. LAUNCHER HOLDER
    - Used 3in x 1.5in hollow steel.
    - Length: 1.2ft (0.368m).
    - Needed: Two (2) parts.

6. PADDLE
   - Used 3in x 1.5in hollow steel.
   - Length: 1ft (0.3m).

7. TRIGGER'S SOCKET
   - Used 2.1in x 1.1in hollow steel.
   - Length: 2in (0.051m).

8. LAUNCHER HOLDER'S SOCKET
   - Used 3.1in x 1.5in hollow steel.
   - Length: 3in (0.726m).
   - Needed: Two (2) parts.

9. PLATE
   - Used 6in^2 of steel plate.
   - Attach at paddle's tip.

FIGURE 3.9 PROCESS MEASURING

FIGURE 3.10 PROCESS CUTTING STEEL

3.3.2 WELDING

In this project, we use a type of tungsten inert gas (TIG) welding. We chose this type of welding because we only needed to attach the thin steel part. So the iron part is not damaged or badly damaged. We also use tack techniques to position the iron and new welding parts.

FIGURE 3.11

3.3.4 DRILLING

This project needs to be drilled. The parts that need to be drilled are the launcher handle section, trigger socket and level pad on the paddle. We used a 10mm diameter drill to make these holes.

3.4 METHODOLOGY FLOW CHART

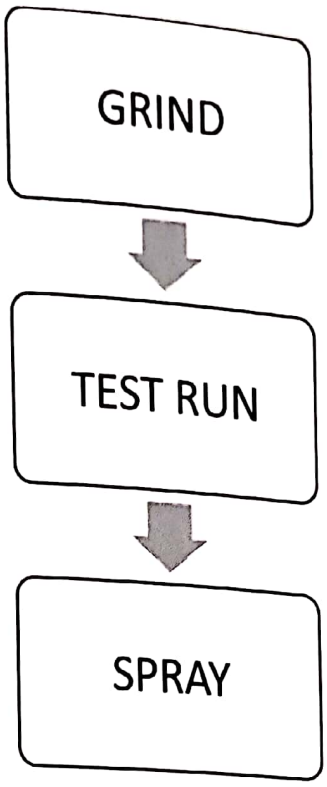


CHART 3.3

3.4.1 GRINDING WORK

Grinding works are done using a mobile type hand grinding machine. It is made to remove and flatten excess welding after full welding process. All steel hollow welds and welded plates must be welded to smooth work.

3.4.2 PROCESS TEST RUN PITCHING MACHINE

After the digging process the test on the pitching machine is carried out to determine the main purpose of this machine to work properly or vice versa. Any problems during testing need to be researched and solved for safe operation of the machine.

3.4.3 PROCESS SPRAYING

Before the painting process can be done, the machine parts consisting of the handles and feet must be cleaned first using a wire brush or a brush. After that, only the painting work was done to beautify and refine the design. The process of painting using spray method. This process uses one tin of silver. After the paint spraying process, the machine was left to dry at normal temperatures.

3.5 SUMMARY

From the research that we have done, we come up with new ideas due to that we changed the design of the pitching structure. For instance, we add up another steel rod and we placed support for sprinkler unit. Before the project started, we ensure whether the material and equipment found are suitable for our project or not. We also done another research on the material and equipment used to make sure the project completely not waste our money. The project was started after we found the Abdary Maju Niaga then, we done modification to achieve our design according to the concept and scope. The usages of the product are to make pitching throw ball repeatedly and easy to handling. The main purpose of our project is to design a machine that could help pitcher will running on efficiency.

CHAPTER 4: RESULTS & DISCUSSION

4.1 INTRODUCTION

This chapter combine data and analysis of the launcher through certain high. This data and analysis are very important for this project to achieve the objective and scope of the project. This data indicate the successful, accuracy and precision shot from the launcher to the target. After getting all this data, we analyze every single possible to make it accurate and high precision.

PREPARED BY: HAIRIE HAKIMI BIN AMIRUIN (08DKM17F1099)

4.2 DATA FROM LAUNCH BALL

CRICKET		BASEBALL		TENNIS	
Level	**Distance (m)**	**Level**	**Distance (m)**	**Level**	**Distance (m)**
1	4 – 5	1	3 – 4	1	3 – 5
2	6 – 7	2	5 – 6	2	5 – 6
3	8 - 9	3	7 - 8	3	8 - 9
Weight (g)	**113 - 160**	**Weight (g)**	**142 - 149**	**Weight (g)**	**56.7**

TABLE 4.1

PREPARED BY: VIMALLAN PALANIANDY (08DKM17F1243)

4.3 SPRING STRETCH DATA

This is the results of the length of the spring taken before and after in cm.

LEVEL	1	2	3
BEFORE (cm)	20	22	25
AFTER (cm)	30	38	40

TABLE 4.2

PREPARED BY: MUHAMMAD FAKHRUL HAZZIM BIN MOHD HAFIZ (08DKM17F1231)

4.4 DATA OF BALL'S VELOCITY

CRICKET			BASEBALL			TENNIS		
Level	Time (s)	Velocity (m/s)	Level	Time(s)	Velocity (m/s)	Level	Time(s)	Velocity (m/s)
1	0.89	5.618	1	1.25	4.001	1	0.98	5.102
2	0.75	6.667	2	0.89	5.618	2	0.76	6.579
3	0.59	8.475	3	0.65	8.929	3	0.59	8.475

TABLE 4.3

4.5 DISCUSSION

The group members done a discussion before proceed this project. A lot of mistake were detected to improve the flow of the project. Many ideas were discussed to apply in the process of doing project. We also seek supervisor and lectures comment and recommendation about the design of this project.

CHAPTER 5: CONCLUSION

5.1 CONCLUSION

This project will enhance the knowledge and experience of applying and adapting the skill that we had learnt and gained for five semester in Politeknik Sultan Salahuddin Abdul Aziz Shah. After we successfully finished our project "The Black Inferno Pitching Machine", we earn a lot of knowledge of solving this problems , able to think high order thinking skills, answering questions that strike our mind based on the project, completing the table, modified and solve some problems and cooperation between us finally gave us result of invent a new product. The implementation of the project needs our responsibility and information management skills while engaging in teamwork acquisition of new knowledge and skill to develop a project. Therefore, teamwork also considered as vital role in completing this project. We can conclude that our project has achieved the objective and scope that we set as early. We sure that this product will help them and make their work easier, helpful and profitable as compared to the machine they owned for each and every process now.

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