FABRICATION OF LOW COST BALL MILLING MACHINE

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ABSTRACT
This project is to design and fabricate a mini ball mill that can grind the solid state of raw materials into fine powder. Ball mill is a cylindrical device that used to grind and blend raw materials and it rotates around a horizontal axis, partially filled with the material to be ground plus the grinding medium. When it is controlled by speed, the load nearest the wall of the cylinders will break and it quickly followed by other particle in the top curves and form a sliding stream containing several layers of balls separated by material of varying thickness. Ball milling must be operated in a closed system, with oversize material continuously being recirculated back into the mill to be reduced due to internal cascading effect. In our project, we need to fabricate a low cost mini ball mill. To fabricate this ball mill, we first design a model using Solidwork and checked for interferences. Then, we start looking for suitable material to fabricate the jar and carry out machining in lab to make some supporting parts such as shaft and metal block. After all parts are done fabricated in desired dimension, testing is carried out to determine whether the raw material selected can be grinded into powder form. Lastly, a metal bar is added inside the jar to lift up the stainless steel balls to fall from higher position so that the specimen can be crushed which is known as cascading effect.

INTRODUCTION:
Ball mill is machine which can able to make the glass particles into the grain size particles. In these machine, grinding particles can make with glass material perfectly, it gives high quality grain size particles, in these machine we can able to make the perfect seize of the grain size particles. A ball mill consists of a hollow cylindrical shell rotating about its axis.

The axis of the shell may be either horizontal or at a small angle to the horizontal. It is partially filled with balls. The grinding media is the balls, which may be made of steel...
(chrome steel), stainless steel, ceramic, or rubber.

The inner surface of the cylindrical shell is usually lined with an abrasion-resistant material such as manganese steel or rubber. Less wear takes place in rubber lined mills. The length of the mill is approximately equal to its diameter. When it is controlled by speed, the load nearest the wall of the cylinders will break and it quickly followed by other particle in the top curves and form a sliding stream containing several layers of balls separated by material of varying thickness. Ball milling must be operated in a closed system, with oversize material continuously being recirculated back into the mill to be reduced due to internal cascading effect. In our project, we need to fabricate a low cost mini ball mill.

**LECTURE SURVEY**

A ball mill is a type of grinder used to grind and blend glass materials. It works on the principle of impact and attrition: size reduction is done by impact as the balls drop from near the top of the shell.

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The general idea behind the ball mill is an ancient one, but it was not until the industrial revolution and the invention of steam power that an effective ball milling machine could be built. It is reported to have been used for grinding flint for pottery in 1870. In case of continuously operated ball mill, the material to be ground is fed from the left through a 60° cone and the product is discharged through a 30° cone to the right. As the shell rotates, the balls are lifted up on the rising side of the shell and then they cascade down (or drop down on to the feed), from near the top of the shell. In doing so, the solid particles in between the balls and ground are reduced in size by impact.

A ball mill, a type of grinder, is a cylindrical device used in grinding (or mixing) materials like ores, chemicals, ceramic raw
materials and paints. Ball mills rotate around a horizontal axis, partially filled with the material to be ground plus the grinding medium. Different materials are used as media, including ceramic balls, flint pebbles and stainless steel balls. An internal cascading effect reduces the material to a fine powder.

Industrial ball mills can operate continuously, fed at one end and discharged at the other end. Large to medium-sized ball mills are mechanically rotated on their axis, but small ones normally consist of a cylindrical capped container that sits on two drive shafts (pulleys and belts are used to transmit rotary motion). A rock tumbler functions on the same principle. Ball mills are also used in pyrotechnics and the manufacture of black powder, but cannot be used in the preparation of some pyrotechnic mixtures such as flash powder because of their sensitivity to impact. High-quality ball mills are potentially expensive and can grind mixture particles to as small as 5 nm, enormously increasing surface area and reaction rates.

The grinding works on the principle of critical speed. Critical speed can be understood as that speed after which the steel balls (which are responsible for the grinding of particles) start rotating along the direction of the cylindrical device; thus causing no further grinding.

Ball mills are used extensively in the mechanical alloying process [5] in which they are not only used for grinding but for cold welding as well, with the purpose of producing alloys from powders. [6]

The ball mill is a key piece of equipment for grinding crushed materials, and it is widely used in production lines for powders such as cement, silicates, refractory material, fertilizer, glass ceramics, etc. as well as for dressing of both ferrous and non-ferrous metals. The ball mill can grind various ores and other materials either wet or dry. There are two kinds of ball mill, grate type and over fall type due to different ways of discharging material. Many types of grinding media are suitable for use in a ball mill, each material having its own specific properties and advantages. Key properties of grinding media are size, density, hardness, and composition.

- **Size:** The smaller the media particles, the smaller the particle size of the final product. At the same time, the grinding media particles should be substantially larger than
the largest pieces of material to be ground.

- **Density**: The media should be denser than the material being ground. It becomes a problem if the grinding media floats on top of the material to be ground.

- **Hardness**: The grinding media needs to be durable enough to grind the material, but where possible should not be so tough that it also wears down the tumbler at a fast pace.

- **Composition**: Various grinding applications have special requirements. Some of these requirements are based on the fact that some of the grinding media will be in the finished product. Others are based in how the media will react with the material being ground.

**COMPONENTS:**

**INDUCTION MOTOR:**

An induction motor or asynchronous motor is an AC electric motor in which the electric current in the rotor needed to produce torque is obtained by electromagnetic induction from the magnetic field of the stator winding. An induction motor can therefore be made without electrical connections to the rotor. an induction motor’s rotor can be either wound type or squirrel cage type.

**BELT DRIVE:**

A belt is a looped strip of flexible material used to mechanically link two or more rotating shafts. A belt drive offers smooth transmission of power between shafts at a considerable distance. **Belt drives** are used as the source of motion to transfer to efficiently transmit power or to track relative movement.

**BELT DRIVE SPEED CALCULATION:**

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\text{TYRE DIAMETER} = \frac{\text{MPH} \times \text{GEAR RATIO} \times 336}{\text{RPM}}
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\text{GEAR RATIO} = \frac{\text{RPM} \times \text{TYRE DIAMETER}}{\text{MPH} \times 336}
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\text{MPH} = \frac{\text{RPM} \times \text{TYRE DIAMETER}}{\text{GEAR RATIO} \times 336}
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\]
PINION:

Pinion is used to transfer the mechanical energy with the help of the belt drive. By using different pinion size, we can able to obtain the different speed ration. Two pinion was used in these system. One pinion was connected with motor and another pinion was connected with the roller cylinder. Pinion is made up of cast iron so that it can able to interact with the belt perfectly. In these case pinion is used to just rotate the roller cylinder in effective manner, so that speed ratio is not much important to these case. The figure for the pinion Is given below.

BEARINGS:

A bearing is a machine element that constrains relative motion to only the desired motion, and reduce friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that act on the moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of the loads (forces) applied to the parts.

FRAME STAND:

Frame stand is used to fix all components in perfect manner so that each components work in effective manner in these case each component should fix in perfect manner because it produce over vibration during the time of working. frame was designed.
as per the machine requirement so the during the working time it won’t make any problem.

**WORKING:**

The working process of the ball mill is simple to understand, broken glass pieces will have inserted in the roller cylinder after stainless steel balls will put inside the roller cylinder. Then roller cylinder inlet will have closed. After that power will supply to the system then induction motor will get rotate in effective manner. A ball mill consists of a hollow cylindrical shell rotating about its axis. The axis of the shell may be either horizontal or at a small angle to the horizontal. It is partially filled with balls. The grinding media is the balls, which may be made of steel (stainless steel, ceramic, or rubber. The inner surface of the cylindrical shell is usually lined with an abrasion-resistant material such as stainless steel. Less wear takes place in rubber lined mills. The length of the mill is approximately equal to its diameter. When it is controlled by speed, the load nearest the wall of the cylinders will break and it quickly followed by other particle in the top curves and form a sliding stream containing several layers of balls separated by material of varying thickness. Ball milling must be operated in a closed system, with oversize material continuously being recirculated back into the mill to be reduced due to internal cascading effect. In our project, we need to fabricate a low cost mini ball mill. Then pinion attach to the motor shaft will supply mechanical energy through the v belt to another end of the pinion so that roller cylinder will get rotate in effective manner then stainless steel will get break the glass particle in effective manner

**ADVANTAGES:**

1. The cost of installation and grinding medium is low.
2. It is suitable for both batch and continuous operation.
3. It is suitable for open as well as closed circuit grinding.
4. It is applicable for materials of all degrees of hardness.

**DISADVANTAGES:**

1) High hardness material does not suitable for these machine
2) For more stronger glass material it take more time to done the process.

**CONCLUSION:**

The working process of the ball mill is clearly explained and the grain size quality and grain size particle making procedures with
glass is clearly discusses. And also the fabrication procedure is clearly explained in effective manner. The energy conversation process is also discussing clearly. The process take place inside roller cylinder is explained well manner and hence we can conclude that we can able to make the grain size particle by using the glass particle with the help of the ball mill machine.

REFERENCE:


