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Analysis of Crank and Shaft Mechanism

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A B S T R A C T

A crank and shaft drive mechanism is used in the sand sieve machine that has been constructed. These elements communicate with one another. The contact that occurred will be explained in this presentation. Abaqus software will be used to model the interaction. Preprocessing includes creating 3D pictures, characterizing the material, and defining load and boundary conditions, among other things. Then there's the analysis, which uses the results of the preceding phase as input to a finite element code. Finally, post-processing refers to the output of the software after it has analyzed the data in the form of stresses. The von Mises stress for contact between the three pieces and the stress distribution along the key are the outcomes of this session. The contact mechanics of the sand sieving machine may be used to make the most optimal design so that users can operate it smoothly, according to the results of this seminar. As a result, the Sieving Machine was designed and manufactured to assist industrialists and farmers on the global market. The benefit is the ability to easily separate objects according to mesh, as well as a reduction in costs related with electricity usage, an improvement in production rate, and the ability to generate less space, among other things.

Keywords: Crank, Shaft, Sieving Machine, Grinder, Mechanism.

1. INTRODUCTION

The crank and shaft mechanism is a four-bar linkage that converts linear motion to rotational motion and vice versa. Internal combustion engines, in which burning in a cylinder produces pressure that powers a piston, are a common example of this mechanism. A mutual link, referred to as the connecting rod, converts the piston's linear motion into rotating motion at the crank. Shaking forces are generated and applied to the crank's housing as the shape of the crank causes the conversion of linear motion to rotational motion. Vibrations caused by these shaking forces obstruct the engine's operation.

In undergraduate engineering classes, the crank and shaft mechanism is widely used to explore machine kinematics and the consequent dynamic forces. Analytical calculations can be used to calculate the position, velocity, acceleration, and shaking forces generated by a crank and shaft system during operation. Certain elements are frequently overlooked in analytical calculations, resulting in results that are inconsistent with experimental data. The angular velocity of the crankshaft is commonly assumed to be constant. In actuality, the power stroke has a somewhat higher angular velocity than the return stroke. The investigation of these little variations yields useful information about the properties of piston-driven engines.

The design, manufacture, and testing of a pneumatically powered crank and shaft mechanism for classroom display and experimentation are detailed in the following report. The engine's kinematics were thoroughly examined under the assumption of continuous angular acceleration. The imbalanced mechanism's shaking forces were computed, and balancing weights for statically and dynamically balanced systems with the same constant angular velocity were created. During operation, transducers attached on the mechanism recorded kinematic and dynamic force data, which was then compared to analytical values.

The engine was built successfully and performs as expected. The accelerometer data recorded by the gadget is comparable to estimated acceleration and shaking force values. The engine functioned satisfactorily with with minor tuning. With a balancing weight tuned for 200 RPM, the engine can operate at angular velocities ranging from 80 to 330 RPM. Sustained motion may be achieved with cylinder pressures as low as 4.5 psi and a system pressure loss of only 2 psi. The use of balance weights results in a reduction in shaking force, which is visible both visually and in recorded data. When compared to analytical calculations, all of the experimental results were credible.

A multipurpose sieving machine is used to separate desired elements from unwanted material, as well as to characterize the element to the required size using a sample allocation. Using a mesh or net as a pane. To separate and break up clumps in dry component particles like sand and wheat, a sifter is employed. This project focuses on providing descriptions of all of the essential DC motor functioning concepts and design. Sieving education plays a significant role in the functioning of numerous sectors. The systematic approach is used to construct a work device under a constraint. The primary goal of Sieving Machine study is to integrate various skills and information and to point students in the direction of practical application. It aids in the development of new ideas and possibilities for possible applications. Sieving is a simple method for separating particles of different sizes. To sift flour core, this sieve has very fine little holes.

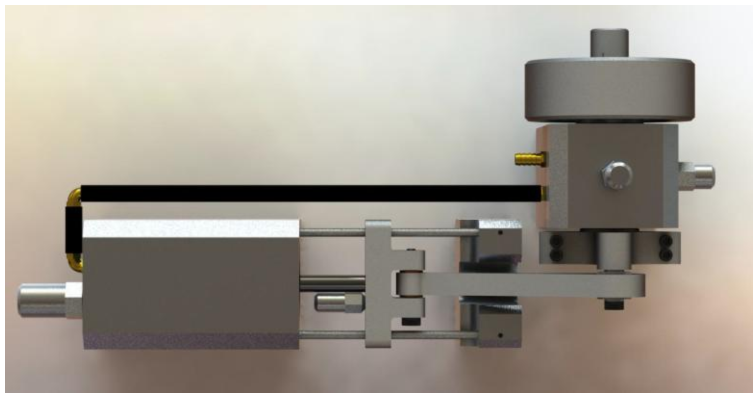

Fig.1.1: Top View Solid Model of Crank Mechanism

2. CRANKSHAFT MECHANISM:

The crankshaft is utilized to efficiently transfer reciprocating motion/power from the piston to the gear/clutch in the desired velocity/torque ratios. Any crankshaft problem, on the other hand, will degrade the engine's performance. Crankshafts are employed in rotating machines such as engines and generators. They communicate the flywheels' massive loads and the engines' internal gaseous pressure at a very high rate. To avoid widespread damage or catastrophe, any failure in the crankshaft must be detected and reported by the operator or driver as soon as possible. It is critical to detect faults/defects as soon as possible in order to keep the entire system from coming to a halt. The crankshaft is made up of shaft parts that rotate in primary bearings, crankpins that link the connecting rod's large ends, and crank arms or webs (also known as cheeks) that connect the crankpins and shaft parts.
Depending on the position of the crank, the crankshaft can be classified into two types:
1. Overhung crankshaft or side crankshaft
2. Crankshaft in the middle

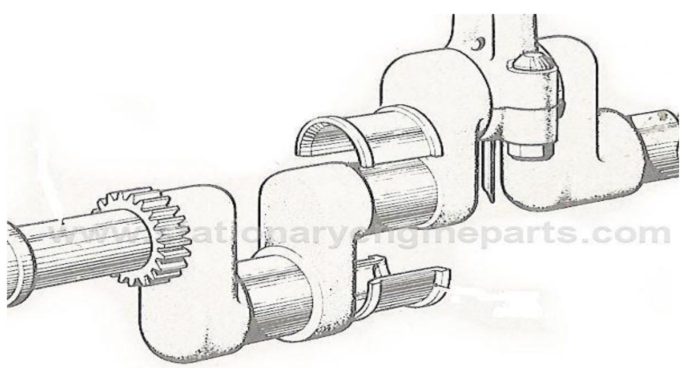

Fig.2.1: Connecting Rods in Crankshaft

2.1 Analysis of Crank Shaft:

A number used to describe the size of a sieve, usually the number of apertures per inch. The size of the openings between a testing sieve's crossed wires. The sand sieving machine is simple to put together and to run. A handle, crank, and slotted link mechanism, bearing, rail track, sieving box, and collecting box were used to construct this. The eccentric pendulum mechanism drives the horizontal sieve machine. The collecting box moves on a rail track that is attached to the base. When the shaft reciprocates, the collecting box is fastened to the shaft. The machine is started once the sieve box is placed inside the collecting box. The sieving procedure is carried out while the collecting box moves in a reciprocating motion. An eccentric pendulum-operated two-level screening machine separates different sizes of coal, coffee powder, and sand. The components with a larger size remain on the vibrating screen's upper layer. The smaller components fall to the second screen, and the tray is filled with smaller components. As a result, screens are used to segregate the various component sizes.

A sieve, also known as a riddle, is a mechanical vibrating element that is used to separate needed elements from undesired material. It is also used to characterize the element to the required size by assigning a sample. Using a mesh or net as a pane. Sifter is a tool that is used to separate and break up clumps in dry component particles such as sand and flour. This project focuses on providing descriptions of all of the essential DC motor functioning concepts and design. Sieving education plays a significant role in the functioning of numerous sectors. The systematic approach is used to construct the work device under the constraints. The primary goal of Sieving Machine study is to integrate various skills and information and to point students in the direction of practical application. It aids in the development of new ideas and possibilities for possible applications. Sieving is a straightforward method for separating particles of various sizes. This sieve has very fine little pores that are used to sift flour core. Grind against one another and screen apertures separate or break up the fine Coarse particles. For the separation of industrial wastes such as bolts, nuts, washers, and nails of varied particle sizes of the holes, many types of sieves are utilized. Similar sieves are frequently employed in the manufacturing of agricultural equipment. Sieves are also used to separate stones from sand and grains while grading grain size.

3. WORKING PRINCIPLE OF CRANK AND SHAFT

The connecting rod drives the crankshaft to rotate around the X axis of the engine. The geometry and loading of the crankshaft will cause significant torsional stress in the shaft, which must be calculated to its maximum value. The assumption is made that one end of the shaft is locked by the flywheel while the other is subjected to the torque created by the device at maximum operational speed in order to depict a worst-case stress situation. The crankshaft's geometry and loading will result in negligible bending, thus it will be ignored. The maximum operational angular velocity is considered to be 500 rpm (52.4 rad/s), which is a conservatively big value.

Fig.3.1: Crank-Shaft Fixtured for 4th Axis Machining

3.1 Crankshaft Operations and Fourth Axis Machining

The team used the CAM software Esprit to create each of the project's components. It was feasible to use the Solidworks model to construct the necessary tool-paths in order to physically produce the parts with this program. Existing geometry was used to create features, which were then used to perform operations on. The group had to establish acceptable Surface footage per minute and feed-rates based on tool shape and material, as well as work-piece material, for the processes. Manufacturing will be focused on the crankshaft for the purposes of this report.

A piece of 5" SAE-1018 Plain Carbon Steel stock material was needed to make the crank. A horizontal band-saw was used to cut the stock to the proper length (8.5"). The stock had to be turned to a specified geometry for the following operation, which necessitated the usage of the HAAS SL20 CNC Lathe. To get the stock into the machine, the team had to first bore the jaws (in a three-jaw chuck) to the correct 5" diameter. This was performed utilizing a 34-inch boring bar and the lathe's intuitive turning option. The next step was to face and chamfer each side of the stock so that it sat squarely in the chuck and maintained machine concentricity. The stock was additionally center-drilled on one side, allowing the stock to be supported by the tailstock and live center.

When bored to the nominal size, the bearing's inner diameter was 0.004" larger, necessitating an enlarged crankshaft to compensate. The following is the CAM file simulation for the turning operation:

After that, the stock was reduced to the nominal fit needed by the design tolerances. This allowed the team to compare the actual turned diameter to the machine's expected output. The team discovered that the machined output for an Outer Diameter turning operation was 0.004" more than anticipated. Taking this divergence from the predicted output into consideration, the team adjusted the tool offset within the machine to compensate for it. To compensate for the discrepancy, the group measured the bronze bearing in the same way when drilling the inner diameter to fulfill the design tolerance standards. After the offsets were taken into account, the crankshaft's ultimate dimension was 1.1292" and the bearing's inner diameter was 1.1300". The clearance generated was within the Class RC-3 Precision Sliding Fit's stated range. However, due to initial measurement difficulties and machine capabilities, the shaft diameter and bore of the bearing were enlarged.

4. Conclusion

The aforementioned seminar concluded that the crank and shaft mechanism plays an essential role in multipurpose sieving machines. Interfacing parts fulfilled specified specifications and performed as expected. When compared to analytical calculations, all of the experimental results were credible. Assembly was done in a way that allowed for gradual modifications, which reduced system friction. The engine functioned satisfactorily with with minor tuning. Static loading study of the crankshaft produces inflated results, but dynamic loading analysis produces more accurate stresses. Accurate stresses are essential for fatigue study and crankshaft optimization.

References

A.K.Nachimuthu, 2014 "Analysis and optimizing connecting rod for weight and cost reduction", International Journal of Research and Innovation in Engineering Technology.

Arun Kumar N., Srinivasan V., Krishna Kumar P., Analysing the strength of unidirectional fiber orientations under transverse static load, International Journal of Applied Engineering Research, v-9, i-22, pp7749-7754, 2014. Standard Classification for Cost Estimate Classification System, ASTM E25.

Ashok G.Ambekar, mechanism and machine theory, prentice-hall india, 2007, newdelhi, pp800-805.

Ganeshram V., Achudhan M., Synthesis and characterization of phenol-formaldehyde resin as a binder used for coated abrasives, Indian Journal of Science and Technology, v-6, i-SUPPL.6, pp-4814-4823, 2013.

Raja Kumar G., Achudhan M., Srinivasa Rao G., Studies on corrosion behavior of borated stainless steel (304B) welds, International Journal of Applied Engineering Research, v-9, i-22, pp-7767-7772, 2014.

Vatroslav grubisic, fatigue failure of automobile components, fraunhofer institute of reliability, 12th oct 2004. Tokyo, pp. 01-37.