Alenogines L. San Diego et al. 2016, Volume 4 Issue 5
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

International Journal of Science, Engineering and Technology
An Open Access Journal

Remote Controlled Sand and Gravel Sorter Machine: A Prototype

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Abstract

The remote controlled sand and gravel sorter machine is a prototype of the existing inclined vibrating screen using AC motor, v-belt pulley and pillow blocks to produce its longitude motion. The machine is designed for faster segregation of sand from gravel or aggregates which is much more advantageous from the traditional sand and gravel manual sorting. Less time consumed and faster operations are the major purposes of the machine.

The machine is economically equipped to users' requirement with two screen layers for choices of desired diameter of sand and stone. The first layer is a thin metal and perforated with mesh composed of circular holes with ½" diameter, a second layer with a screen mesh of 1/8" diameter and a third layer made of plain sheet. The machine outputs are ½" gravel, 1/8" mixed sand, and 1/8"fine sand respectively.

The AC motor used is a ¼ hp, 220V, with 1800 revolution per minute (rpm) and the v-belt and pulley reduces the motor speed to 400 rpm. The motor creates the required vibration in such a way that the material in the machine will be getting screened.

The machine is compact and simple design with a detachable remote control panel. The control panel is composed of pushbuttons, magnetic contactor, circuit breaker, indicating lamps, connecting wires, and a convenience outlet. The machine capacity is measured through number of minutes it finishes to segregate a sack of sand and gravel. The machine is design intended for a small size hollow block "chb" manufacturer, aggregate screening and residential masonry works.

Keywords: Remote Controlled Sorter, Functionality, Reliability, Safety, and Aesthetic.

Background of the Study

Nowadays, different researches about industrial technology are broadly undertaken by professionals and students. Most common problem is in terms of reproducing new machines and equipment in different companies. This generation, many of these processes flow were being shown through various instructional control trainers and prototypes.

One of the companies that developed new machine that perfected a simple drive arrangement on large horizontal and inclined motion screens is the Star Trace Industry. This development has resulted in tremendous advantages as far as reduced maintenance, compactness and simplicity in the design of a linear vibrating screen (www.Alibaba.com, 2010).

This brings the idea of the researchers to develop the "Remote Controlled Sand and Gravel Sorter Machine: A Prototype". The machine is designed intended for small size hollow block "chb" manufacturer, aggregate screening and residential masonry works.

The machine is designed for faster segregation of sand from gravel or aggregates which is much more advantageous from the traditional sand and gravel manual sorting. Less time consumed and faster operations are the major purposes of the machine.

On the other hand, this prototype is also designed as an instructional demonstration device that is use to

enhance the teaching-learning process on the principle of vibrating screen and motor control application. The device also demonstrates how it differs from manual operation in sorting sand and gravel.

With the control panel, the students will do the actual control of the machine. AC motor, shafting, pillow blocks, V belt pulley, and capacitor are the important components to produce the longitude movement of the screen.

Instructional trainers, based on the research studies conducted on the development of instructional devices, are significant in enhancing the teaching methodology and learning process of the teacher and the students respectively (San Diego, et. al, 2011 and Da Asis, et. al., 2012).

Objectives of the Study

In order to accommodate and accomplish a complete set of the research, the researcher issued some basic objectives and studies to make the research efficient.

The following are the objectives of the research project:

1. To design the remote controlled sand and gravel sorter machine.

2. To fabricate the remote controlled sand and gravel sorter machine.

3. To evaluate the remote controlled sand and gravel sorter machine.

Methodology

Design

The researchers gave more emphasis on how the remote controlled sand and gravel sorter machine differs from the manual operations of separating sand and gravel with the use of human force. Having the AC motor with 1/4 horsepower 220 volts AC with 1800 rpm, the V belt and pulley to reduce the motors' speed to 400 revolution per minute (rpm), and a detachable control panel as the main parts of the machine. The detachable control panel is composed of electrolytic push buttons, magnetic contactor, circuit breaker, connecting wires, and a convenience outlet. The machines capacity is measured through number of minutes it finishes to segregate a sack of sand and gravel. The machine's body part is consisting of thin metals, angle bars and metal steels.

The prototype is composed of two screen layers for choices of desired diameter of sand and stone. The first layer is a thin metal and perforated which means compose of circular holes with ½" diameter. The second layer is a screen mesh with 1/8" diameter.

Size of Electric Motor

By the "Rules of Thumb", since the equipment can be operated by hand, a ¼ hp motor is adequate to drive the screen.

Pulley and V-Belt Drives

Since the motor used is less than 2 hp, which is only ¼ hp, a 2 inches diameter pulley for the motor is used to prevent slippage. For the larger pulley that is used to reduce the speed from 1800rpm to 400 rpm, the computation is shown below.

D1= 2inches, diameter of small pulley

D2= diameter of large pulley

RPM1=1800(motor)

RPM2= 400

By ratio and proportion: $D2 = (RPM1/RPM2) \times D1$

$$D2 = (1800/400) \times 2$$

D2= 9 inches diameter of the large pulley

V-belt type FHP was used, since it is thinner and more flexible than other V-belts, and is suited for pulleys less than 2 1/2" in diameter and on motors of less than 1 hp.

Screen Capacity

The screen width is 16" with length of 27" and a bed depth of 6.5". The screen is inclined at 18 degrees angle.

The machine capacity is measured through number of minutes it finishes to segregate a sack of sand and gravel. This is done through manual feeding of one sack of sand and gravel.

Table 1 shows the screen area, mesh diameter and the corresponding sand and gravel output size.

Table 1: Screen mesh, area and machine output.

Layer	Screen Area	Mesh Diameter	Sand/Gravel Output
Layer 1	33.5x15in.	1/2"	>1/2" Gravel
Layer 2	28.75x15in.	1/8"	>1/8"Mixed Sand
Layer 3	Plain Sheet	Plain Sheet	<1/8"Fine Sand

1 sack of sand and gravel = 4 minutes and 22 seconds of segregation

Therefore: 60 minutes = 14.2 or 14 sacks per hour

Figure 2 shows the design and the dimensions of the remote controlled sand and gravel sorter machine.

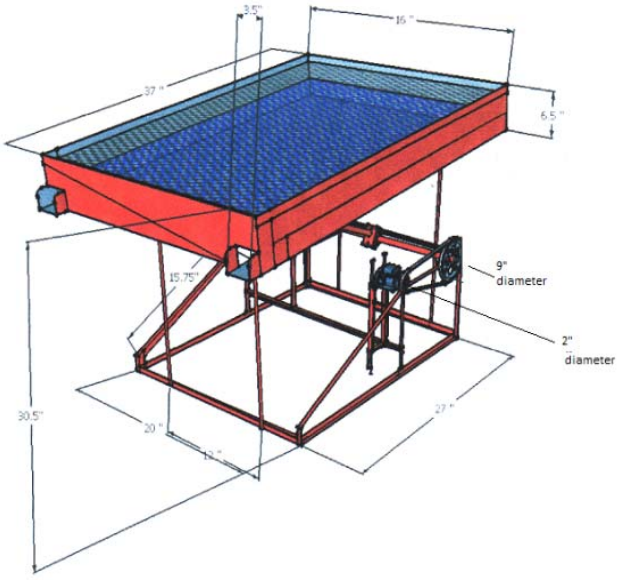

Fig. 1: Design and Dimensions of the Remote Controlled Sand and Gravel Sorter Machine

Electrical Design

Figure 1 shows the electrical control of the detachable remote controlled sand and gravel sorter machine.

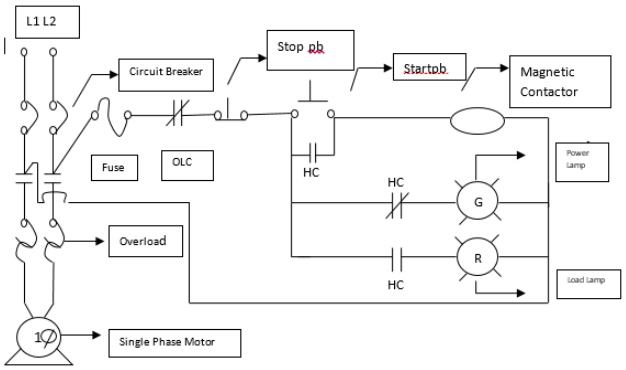

Figure 2: Electrical Control Diagram of the Detachable Remote Controlled Sand and Gravel Sorter Machine

Implementation

The final design of the project had been implemented, and the conversion was done to achieve the desired function of the device.

Result and Discussion

Evaluation

Table 3 shows the result of the evaluation of the machine

Project Criteria	Sand and Gravel Sorting Machine	
	Mean	Description
Functionality	4.16	Moderately Acceptable
Reliability	4.40	Moderately Acceptable
Safety	4.16	Moderately Acceptable
Aesthetic	4.36	Moderately Acceptable
Over-All Weighted Mean	4.26	Moderately Acceptable

Table 3: Mean Perception of the Extent of Assessment of the Remote Controlled Sand and Gravel Sorter Machine

Table 3 shows the over-all weighted mean of 4.26 which means that the Remote Controlled Sand and Gravel Sorter Machine is moderately acceptable.

In terms of its **functionality**, the machine segregates sand and gravel continuously as designed.

Reliability: All of the elements found in the control board were functional as expected. The machines body frame, motor, pillow block, and v-belt pulley was installed with durability.

Safety: The machine has a fuse and circuit breaker installed on its control board. A machine guard near the motor and pulley is added as recommended. The machine parts were properly welded.

Aesthetics: Implies that the paint color and proper painting was done in the machine. The machine components are properly installed and are located appropriately. The panel control board and its control components were installed properly with proper labels.

Summary of Findings

The researchers have conducted more research related topics to innovate and further develop the existing operations on sorting sand and gravel. The researchers make sure that the fabrication of the machine parts specifically the prototype's mechanical parts: motor, pulley, pillow blocks, first and second screen layers, control board, and mainly the machine's body frame were properly installed as shown in the figures below.

Figure 3: The Completed Remote Controlled Sand and Gravel Sorter Machine

Figure 4: Mechanical Elements

Figure 5: First and Second Layer Screens (Perforated and Screen Mesh)

Figure 6: The Detachable Control Board

Conclusions

1. That the Remote Controlled Sand and Gravel Sorter Machine is a great equipment in terms of segregating sand from gravel rather than using the traditional screen mesh.

2. Engaging the machine, less human force is involved and less time consumed is being met.

3. The pairs of counter weights made of concrete cement are efficient in preventing the machine vibration when in longitude motion.

The result of the survey conducted on the machine was rated moderately acceptable in terms of functionality, reliability, safety, and aesthetic. The machine will be used in small industries like backyard hollow block maker, residential masonry works and even in mining.

Acknowledgement

The researchers would like to thank God for the strength and by making their life meaningful and miraculously possible all the time.

Special acknowledgment to our Colleagues and the University Administration, for their support and cooperation, without them this work may not be possible.

References

1. Unpublished Materials

1.1. San Diego, et. al: "The Electric Motor and Control Simulation Trainer Kit", Institutional Funded research, MUST, Cagayan de Oro, 2011

1.2. De Asis, et al." An Instructional Steam Power Generator: Its Development and Evaluation". Institutional Funded research, MUST, Cagayan de Oro, 2012

2. Internet

2.1. www.quarryacademy.com

2.2. Chemieland International Co., Limited. Vibration screen. November 15, 2010. http://www.alibaba.com/showroom/vibrator-screen.html.

2.3. Shanghai Liquan Mining Machinery Co., Ltd., Circular Vibrating Screen for Sand. December 12, 2010. Available at: www.Alibaba.com.

2.4. Walters, Harold G., Sand and Gravel Sizing. December 5, 2010. www.hgwalters/halnet.com

2.5. Zhengzhou General Mining Machinery Co., Ltd. Inclined Vibrating Screen for Sand and Limestone. December 16, 2010. www.Alibaba.com (2010)

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Copy for Cite this Article- Dr. Alenogines L. San Diego, Prof. Romeo M. De Asis, Engr. Romano Pimentel, "Remote Controlled Sand and Gravel Sorter Machine: A Prototype", *International Journal of Science, Engineering and Technology,* Volume 4 Issue 5: 2016, pp. 752-756.