Installing Additional Air Blaster at Hopper

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Abstract—*Ten production blasts and one single hole confined blast have been monitored in two quarries in order to assess the measurable from of energy in which the energy delivered by the explosive is transformed in rock blasting. To determine the seismic wave energy, the kinetic energy and the fracture energy, respectively, transferred in the blasting process. The moisture content of the air can be reduced by the air blaster. Air blaster can also reduce the down time of the sand stone and also it increases the production and reduces the power consumption. 30% of the cost for overall production will be reduces by an air blaster.*

Keywords—*blasts; cost; sand*

1. INTRODUCTION

An air blaster or air cannon is a de-clogging device composed of two main elements a pressure vessel (storing air pressure) and a triggering mechanism(high speed released of compressed air).They are permanently installed on silos, bins and hoppers walls for all powdery from of materials, and are used for preventing caking and allowing maximum storage capacity.

Air blasters do not need any specific air supply. Available plant air is enough with a minimum of 4 bar air pressure, although 5 to 6 bar are preferred for better results. The average air consumption is moderate and depends on the number of firing per hours, size o0f the pressure vessel, and number of air cannons installed. For instance, a50-liters air cannot consumes 0.60Newton cubic meter/hour at 6 bar air pressure with 2 firing per hour.

The compressed air contained in the pressure vessel is instantly released, and the achieved blast, called the impact force, evacuates material sticking to the walls, as well as breaking potential bridging thanks to the shock wave obtained. The blasts are usually organized by using an automatic sequencer.

2. COMPONENTS OF AIR BLASTER

A. Pressure Relief Valve

The pressure relief valve is a type of valve used to control or limit the pressure in a system or vessel which can build up by a process upset, instrument or equipment failure. The relief valve is designed or set to open at a predetermined set pressure to protect pressure vessels and other equipment from being subjected to pressures that exceed their design limits. When the set pressure is exceeded, the relief valve becomes the path of least resistance as the valve is forced open and a portion of the fluid is diverted through the auxiliary route. As the air is diverted, the pressure inside the vessel will stop rising. Once it reaches the valve's reseating pressure, the valve will close.

B. Cylinder And Piston

Pneumatics cylinders (air cylinder) are mechanical devices which use the power of compressed air to produce a force in a reciprocating linear motion. The air cylinder something forces a piston to over in the desired direction. The piston is a disc or cylinder and the piston rod transfers the force it develops to the object to be moved. Once actuated, compressor air enters into the tube at one end of the piston and, hence, force on the piston. Consequently, the piston becomes displaced (moved) by the compressed air expanding in an attempt to reach atmospheric pressure

Fig 2.1

C. Solenoid Valve

A solenoid valve is an electromechanical device used for controlling liquid or gas flow. The solenoid valve is controlled by electrical current, which is run through a coil. When the coil is energized, a magnetic field is created causing a plunger inside the coil to move. Depending on the design of the valve, the plunger will either open or close the valve. When electrical current is removed from the coil, the valve will return to its de-energized state. In direct-acting solenoid valves, the plunger directly opens and closes an inside the valve in pilot operated valves (also called the servo- type), the plunger opens and closes a pilot orifice. The most common solenoid valve has two ports an inlet port and outlet port. Advanced designs may have three or more ports.

In some solenoid valves the solenoid acts directly on the main valve others use a small complete solenoid valve, known as a pilot, to actuate a larger valve. While the second type is actually a solenoid valve combined with a pneumatically actuated valve, they are sold and packaged as a single unit referred to as a solenoid valve. Piloted valves require much less power to control, but they are noticeably slower. Piloted solenoids usually need full power for a short period of time to open it, and only power to hold it. A direct acting solenoid valve typically operates in 10 milliseconds. The operation time of a piloted valve depends on its size; values are 150 milliseconds.

Fig 2.2

D. Nozzle

A nozzle is a device designed to control the direction or characteristics of a fluid flow (especially to increase velocity) as it enter or exist an enclosed chamber or pipe.

A nozzle is often a pipe or tube of varying cross sectional area and it can be used to direct or modify the flow of a fluid. Nozzles are frequently used to control the rate of flow, speed, direction, mass, shape, and the pressure of the stream that emerges from them. In nozzle velocity of fluid increases on the expense of its pressure energy

E. Compressor

An air compressor is a device that converts power (usually from an electric motor, a diesel engine or a gasoline engine) into kinetics energy by compressing and pressurizing air, which on command, can be released in quick bursts. There are numerous methods of air compression, divided into either positive-displacement or negative-displacement types.

Fig.2.3

Positive-displacement air compressors work by forcing air into a chamber whose volume is decreased to compress the air. Piston-type air compressors use this principle by pumping air into an air chamber through the use of the constant motion of pistons. They use one ways valves to guide air into a chamber, where the air is compressed. Rotary screw compressors also use positive-displacement compression by matching two helical screws that, when turned, guide air into a chamber, whose volume is decreased as the screws turn.

Negative-displacement air compressors include centrifugal compressors. These use centrifugal force generated by spinning impeller to accelerate and then decelerate captured air, which pressurizes it.

3. WORKING

Fig 3.1

A. Air Feeding:

Air supply from the air compressor passes through a 3/2 way solenoid valve feed, the quick release valve (QRV), and reach the trigging mechanism with its piston disc in closed position. The air reservoir is then pressurized in less than 15 seconds, depending on the air pressure and air volume used.

B. Waiting:

Air pressure equilibrium between air circuit, triggering mechanism, and pressure vessel is created.

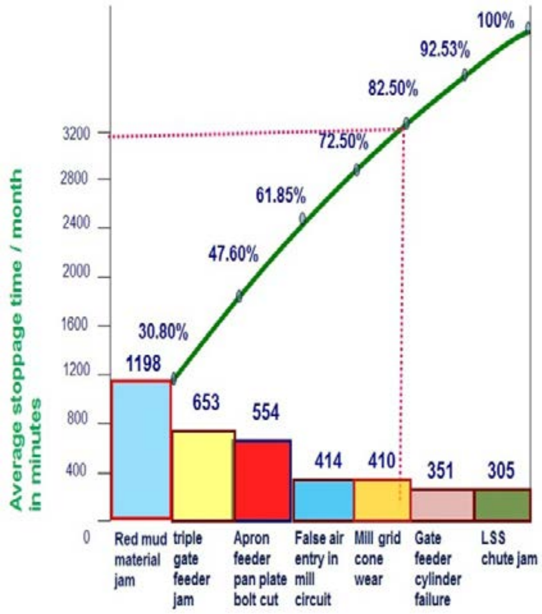
C. Blasting:

When activated a solenoid valve purges the air circuit, thus creating an air vacuum. Then the piston inside triggering mechanism is abruptly pushed back by negative pressure, thus creating a sudden blast from the air contained in the pressure vessel. This phase is measured in milliseconds. The air blast is carried by the pipe and it sends to the nozzle. Nozzle is placed on the hopper. In nozzle the velocity of the air will be increases at the same time the pressure of the air can be reduces. By the application of the high velocity air the moisture content of the sand will be reduces. To neglect the block of the red mud in the hopper the air blast is efficiently used and also it continuous the flow of the red mud. Air blaster can also reduce the down time of the sand stone and also it increases the production and reduces the power consumption. 30% of the cost for overall production will be reduces by an air blaster.

4. IMPLEMENTATION

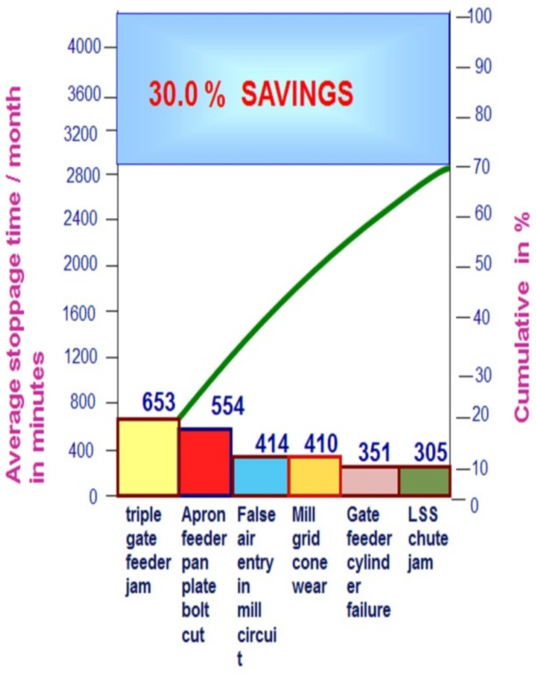
A. Before Implementation

We found material jamming. So we decide to install air blaster in hopper with auto purging.



B. After Implementation

Since it was maintenance free, safe work method, productivity improvement (mill availability),operator fed up due to continuous poking & jam cleaning and cost effective we got approval from our management to fixing the air blaster system.



5. CALCULATION

A. Normal Operating Cycle Time:

NORMAL PRODUCTION

Time taken to restart the mill 35 min

Average production of the mill 188 TPH

Production loss for each tripping 133 THP

Increase in production per month 675 tons

Increase in production per year 9000 tons

NORMAL POWER CONSUMPTION

Consumption of power for each restart600 units

Average tripping per month due to hopper jamming 7 times

Power cost per unit Rs 4.10/unit

Power saved per month Rs 17,220

Power saving per year Rs 2,06,640

MANPOWER COST

Time taken for cleaning the hoppers 3 SHIFTS appx

Man power 2 persons /shift

Cost per cleaning Rs 2,100/-

Saving per month(7 times) Rs 14,700

Saving per year Rs 1,76,400

B.Revised and Modified Operating Cycle Time:

INCREASED PRODUCTION

Time taken to restart the mill 15 min

Average production of the mill 230 TPH

Production loss for each tripping 175 THP

Increase in production per month 875 tons

Increase in production per year10500 tons

REDUCED POWER CONSUMPTION

Consumption of power for each restart500 units

Average trippings per month due to hopper jamming 5 times

Power cost per unit Rs 4.10/unit

Power saved per month Rs 10,250/-

Power saving per yearRs 1, 23,000

REDUCED MANPOWER COST

Time taken for cleaning the hoppers 3 SHIFTS appx

Man power 1persons /shift

Cost per cleaning Rs 1,050/-

Saving per month (5 times) Rs 5250/-

Saving per year Rs 63,000/-

6. CONCLUSION

The AIR BLASTER is the best method to reduce moisture and down time of red sand in the hopper with simple, economic and in efficient manner. These are increase the production, reduces the power consumption, overall production cost is reduced. Moisture content of material is controlled, operating the mill without additives, more dry material required.

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