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Collection of Dust at the Transfer Point of Clinker using Bag Filter

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Abstract - The project is about the collection of dust particles in the transfer point of clinker by using bag filter. During the transfer of clinker into the cement mill hopper there is a huge emission of dust particles. This emission of dust particles is very harmful to the environment. The collection of dust particles in the cement mill hopper is done using bag filter. The dedusting of bag filter is done and the collected clinker is supplied again to the cement mill hopper. This process is obtained to reduce the wastages and atmospheric pollution due to the dust emission during the transfer of clinker into the cement mill hopper.

Keywords: Bagfilter, clinker, hopper.

I.INTRODUCTION

A cement mill is the equipment used to grind the hard, nodular clinker from the cement kiln into the fine grey powder that is cement. Most cement is currently ground in ball mills and also vertical roller mills which are more effective than ball mills.

The emergence of Portland cement made grinding considerably more difficult, because the clinker produced by the kiln is often as hard as the millstone material. Because of this, cement continued to be ground very coarsely (typically 20% over 100 μm particle diameter) until better grinding technology became available. Besides producing un-reactive cement with slow strength growth, this exacerbated the problem of unsoundness. This late, disruptive expansion is caused by hydration of large particles of calcium oxide. Fine grinding lessens this effect, and early cements had to be stored for several months to give the calcium oxide time to hydrate before it was fit for sale. The development of specialized steel led to the development of new forms of grinding equipment, and from this point onward, the typical fineness of cement began a steady rise. The progressive reduction in the proportion of larger, un-reactive cement particles has been partially responsible for the fourfold increase in the strength of Portland cement during the twentieth century. The recent history of the technology has been mainly concerned with reducing the energy consumption of the grinding process.

About ninety-nine percent of all cement used today is Portland cement. The name Portland cement is not a brand name. This name was given to the cement by Joseph Aspdin of Leeds, England who obtained a patent for his product in 1824.The concrete made from the cement resembled the color of the natural limestone quarried on the Isle of Portland in the English Channel. The balance of cement used today consists of masonry cement, which is fifty percent Portland cement and fifty percent ground lime rock.

II.LITERATURE SURVEY

[1] Donald C. Roe et al, a method of suppressing dust generation emanating from cement clinker dust by applying a foamed dust control treatment thereto. The foam is provided with an effective deforming agent which, upon slurring of the clinker and other ingredients (e.g., sand, gypsum, aggregate) to form the desired mortar, inhibits foam formation in the mortar, thus not significantly increasing air entrapped in the slurred mortar.

Cement Kiln Dust (CKD) is a fine powdery material similar in appearance to Portland cement. Fresh cement kiln dusts can be classified as belonging to one of four categories, depending on the kiln process employed and the degree of separation in the dust collection system .There are two types of cement kiln processes: wet-process kilns, which accept feed materials in a slurry form; and dry-process kilns, which accept feed materials in a dry, ground form. In each type of process, the dust can be collected in two ways: a portion of the dust can be separated and returned to the kiln from the dust collection system (e.g., cyclone) closest to the kiln, or the total quantity of dust produced can be recycled or discarded. Large quantities of cement kiln dust are produced during the manufacture of cement clinker by the dry process.

III. GENERAL CEMENT PROCESS

Cement is a binding agent that hardens in air and water and becomes water resistant when hard. It consists mainly of compounds of calcium oxide, silica, alumina the main components of cement are lime, silica, alumina and iron oxide. Seldom are these components found in the need of proportion in only one raw material. Therefore it is usually necessary to select a measured mixture of a high lime component along with a component which is lower in lime, containing however more silica, alumina and iron oxide. These two main components are generally limestone and clay. The components cement manufacturing process can be divided into following process steps.

- Raw Material Preparation
- Clinker Manufacturing
- Cement Manufacturing
- Cement Storage Silo
- Packing and Dispatch
- Central Control Room

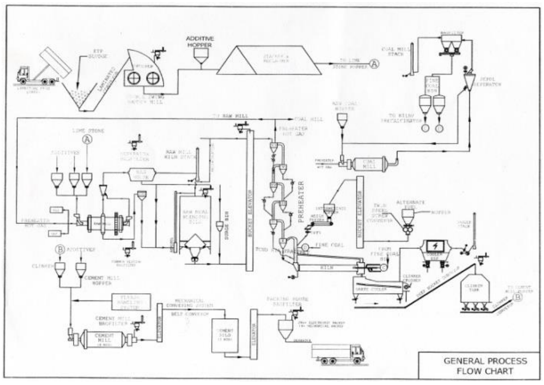

Fig. 1 General cement process

1. Raw Material Preparation

Normally there are various sources of limestone, each with different qualities, which are added with various additives to get the required composition of raw mix. As there are various sources of raw materials, it becomes necessary to blend and homogenize these different materials efficiently to counteract fluctuation in the chemical composition of the raw meal. In order to blend and homogenize the raw materials properly, continuous blending silos are used. The raw meal is then fed at a controlled rate to preheat.

2. Clinker Manufacturing

The raw meal is preheated and calcined in the cyclone preheated and calciner. The preheating of the raw material is of paramount importance for the economical production of cement clinker, preheated systems offer heat transfer from the kiln gases produced during burning process in the kiln. During the calcinations process, at 600 deg C the limestone breaks down into calcium oxide and carbon dioxide. The reaction ends at 900 deg C. The most important activity in cement manufacturing is clinkering (burning) of raw material, which occurs in a rotary kiln. A kiln is the heart of any cement plant. The cooling, cold air is blown to effect heat exchange between hot clinker and cold air. The clinker cooler has to perform the tasks of cooling the clinker discharged from over 1,300^{O} C to 100-125^{O} C.

The hot clinker discharged from the kiln rolls down on the reciprocating grates of the clinker cooler. The cold air is blow from below the grates plates, which cools clinker. Most of the heat given off during clinker cooling is recovered for the use in the production process. Clinker further crushed into size by hammer crusher at the end of cooler or by intermediate/and roll crushers. The crushed clinker is further conveyed to clinker storage y deep pan/deep bucket conveyors.

3. Cement Manufacturing

Clinker, along with additives, is ground in a cement mill. The output of a cement mill is the final product viz. Cement. In a cement mill, there is a cylindrical shell lying horizontal which contains metallic balls and as it rotates, the crushing action of the balls helps in grinding the clinker to fine powder. The term bag house is applied to large filters containing a number of tubular bags mounted in a usually rectangular casing. The dust laden air is drawn through them by suction. The bag house is used to remove dusty particles from discharge of different equipment such as cement mill, coal mill and kiln.

4. Cement Storage Silo

The cement storage silo is used for storing the finished product - cement. There are three silos that can store different weight capacity depending on the needs.

5. Packing and Dispatch

The cement is packed with the help of a rotary packer and finally dispatched to the market. They are disposed through the various modes of transports depending on the availability of sources.

6. Central Control Room

It is the nerve centre of the cement plant since all equipment is controlled from this place. It is the place from where all the process parameters are controlled.

IV. STUDY ON CEMENT MILL DUST

Norms on Dust Emission	< 50 mg/nm^3
Revised Norms	< 30 mg/nm^3
Normal Dust Emission	100 mg/nm^3

This study is to expose that cement dust has significant effects on some haematological parameters while years of exposure was not a significant factor on the haematological parameters of cement depot workers. We recommend that workers exposed to cement dust should be provided with protective materials while routine medical checks should be encouraged.

V. STUDY ON BAG FILTER

A Bag filter (BF), baghouse (BH, B/H), or fabric filter (FF) is an air pollution control device that removes particulates out of air or gas released from commercial processes or combustion for electricity generation. Power plants, steel mills, pharmaceutical producers, food manufacturers, chemical producers, cement industries and other industrial companies often use bag filter to control emission of air pollutants. Bag filter came into widespread use in the late 1970s after the invention of high-temperature fabrics (for use in the filter media) capable of withstanding temperatures over 350 °F. Unlike electrostatic precipitators, where performance may vary significantly depending on process and electrical conditions, functioning baghouses typically have a particulate collection efficiency of 99% or better, even when particle size is very small.

Baghouse types - Cleaning method

- Mechanical Shaker Baghouse
- Reverse Air Baghouse
- Reverse Jet Baghouse

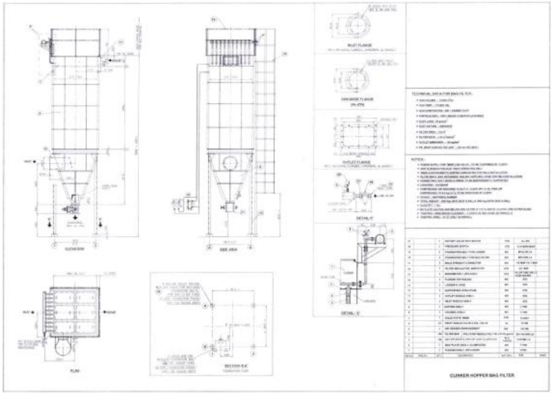

Fig. 2 Bag Filter parameter and dimension

Baghouses are classified by the cleaning method used. The three most common types of baghouses are,

- Mechanical shakers
- Reverse gas and
- Pulsejet

Fabric filter bags (sometimes referred to as envelopes) are oval or round tubes, typically 15–30 feet and 5 to 12 inches in diameter, made of woven or felted material. Depending on chemical and/or moisture content of the gas stream, its temperature, and other conditions, bags may be constructed out of cotton, nylon, polyester, fiberglass or other materials. Reverse air bags have anti-collapse rings sewn into them to prevent pancaking when cleaning energy is applied. Pulse jet filter bags are supported by a metal cage, which keeps the fabric taut. To lengthen the life of filter bags, a thin layer of PTFE (teflon) membrane may be adhered to the filtering side of the fabric, keeping dust particles from becoming embedded in the filter media fibres.

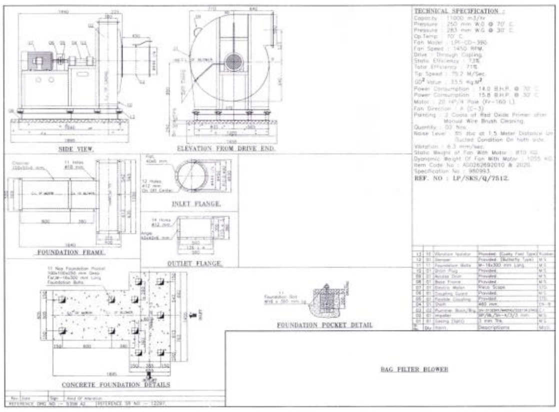

Fig. 3 Bag filter blower

VI. SPECIFICATION OF BAG FILTER AND PARAMETRS

Location : Cement Mill
Equipment : Bag filter
Type : TRL Bag Filter
No. of Bag Filter : 2

Table. 1 Bag filter parameters

Application	Cement mill hopper
Model	100S-12-20 TRL
Gas volume	10,000 m^3/hr
Gas temperature	70^0C
Inlet dust load	50 gm/m^3
Outlet dust emission	<30 mg/Nm^3
Pressure drop across bag filter	150 mm WG
Type of entry	At hopper
Total filtering area	133 sqm
Venturi	MS painted
Cage	MS painted

Equipment : Bag filter bag

Table. 2 Bag filter bag parameters

Bag material	Polyester non-woven needle felt
Weight	550 gm/m^2
Bag size, dia*length mm/mm	116*360
Number of bags	100 Nos
Max allowable temperature	130^0C
Air to cloth ratio	1.23 m3/min/m2

Equipment : Bag filter compressor

Table. 3 Bag filter compressor parameters

Compressed air quantity	35 Nm^3/hr
Compressed air pressure	5-7 kg/cm^2
Pulse cum solenoid valve	10 Nos
Size	250mm
Geared motor rating	1hp/20rpm

Equipment : Bag filter blower

Table. 4 Bag filter b
lower parameters

Type	Centrifugal backward curved
Capacity	11,000 $m^{3/}hr$
St.pressure at Operating temperature	250 mm Wg
Operating temperature	50^0C
Efficiency	Approx.80%
Fan speed	1500 RPM
Drive	Direct coupled
Fan shaft power @ operating	12.54 HP
Motor rating	15/4 HP/Pole

VII. ELEVATION DESIGN

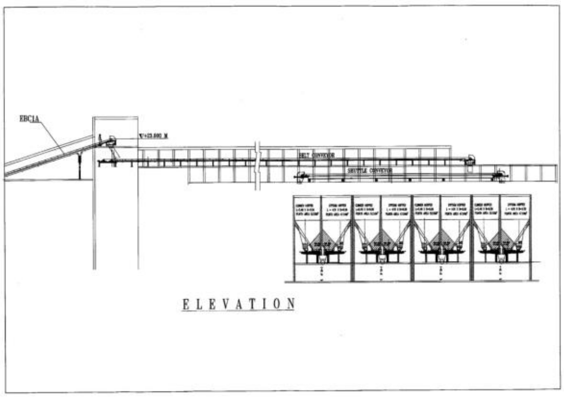

Fig. 4 Cement mill hopper before installing bag filter

This design represents the cement mill hopper before installing bag filter. In the transfer point of clinker there is a huge emission of dust particles. It is the major problem that encountered in the cement mill hopper. In order to reduce the dust particles a bag filter is installed.

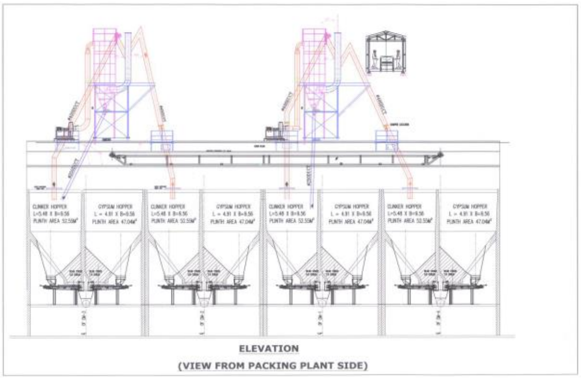

Fig. 5 Cement mill hopper after installing bag filter

This design represents the cement mill hopper after installing bag filter. The bag filters are installed in the transfer point of clinker. It collects the dust particles and reduces the dust emission problem in the atmosphere.

VIII. CONCLUSION

The main objective of this project is to collect the dust emission that occurs in the transfer of clinker into the cement mill hopper. It is collected by using the installation of bag filter in the cement mill hopper. The dedusting of the bag is done in the bag filter and the clinker is collected and again it is transferred into the cement mill hopper. This process does not affect any other process and the filtered air is then liberated in the atmosphere under the values of government norms and conditions.

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