Review on Shot Blasting Processes

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Abstract---Shot blasting is a surface cleaning and finishing process. This review paper includes basic components and significance of the typical shot blasting machine. The whole process has been explained herein along with the broad classification of its different types. A couple of methods have been described viz swinging table and tumblast. The drawbacks of tumblast are concluded hence.

Keywords:- Shot blasting process, Components, Work handling system, tumblast

I. INTRODUCTION

The final stage in the manufacturing of cast products involves the surface treatment and finishing of castings to remove the residues of the moulding and core mix to obtain the required surface quality and condition. Among surface treatment methods, mechanical methods seem prevalent, particularly the abrasive (or shot blasting) methods. Their key advantages include low energy demands, high quality of treated surfaces, good potentials for process automation, and the use of shot blasting units made of more durable materials, work safety and environment-friendly features. In shot blasting processes a stream of abrasive medium with the required kinetic energy is generated and propelled onto the surface to be treated. The stream of the cleaning agent, being a mixture of metal shots [1].

It is possible with the shot blasting operation to obtain excellent cleaning and surface preparation for secondary finishing operations [2]. The shot blasting is a cold surface treatment which involves projecting beads on the work piece to change its surface state. The impacts are made at high velocities (several m/s) and these repeated actions cause the plastic deformation of the workpiece and the development of residual stresses on a thickness of a few hundredths of a millimeter. This treatment improves the mechanical characteristics of pieces by increasing their resistance to fatigue and corrosion [3].

II. BASIC COMPONENTS

A. Shot Blasting Chamber: In Shot Blasting Chamber the blasting process can be done. There is varies type of blasting chamber is constructed as per the application. In Figure 1 shows table and component is lying on the table in the shot blasting chamber for shot blasting process.

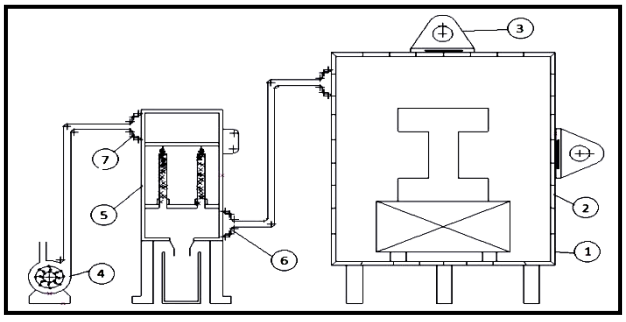

Fig. 1: General diagram of shot blasting machine

B. Internal Liner: Internal liner is one type of tiles made from manganese and steal, in which content of manganese is high. It is high were resistance. Liner is bolted inner side of the shot blasting chamber for protecting wall.

C. Blast Wheel: Abrasive particles are projected by centrifugal force from various kinds of turbine wheels. The number of wheels installed in the machine depends on the type of jobs to be shot blasted and the rate of work. The wheel is the heart of every centrifugal shot-blasting machine.

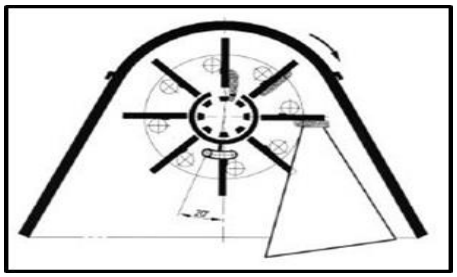

Fig. 2: Blast wheel [1]

Efficiency and cleaning effect depend to a great extent on the quality of the wheel and its components [4]. 17BD150, 25BD130, 25BD150, 25BD195, etc. are the standard size of the bleds [9]. Bled number indicates width and wheel diameter in inches. Flow span of particles from blast wheel is available with 49^o, 70^o, 110^o (Its depend upon slot available on control cage which is one component of blast wheel assembly)

D. Blower: Blower is the component by which dusted air is suck from blasting chamber through dust collector. Dust is collected in dust collector and then only air is drawn out by blower.

E. Dust Collector: This component is externally mounted with the shot blasting machine for collecting the dust which is produce due to blasting process and it is necessary to collect properly. JET III [10] is one type of dust collector which is generally used by NESCO Ltd., Karamsad, Gujarat.

Some features of JET III is high collection efficiency, low initial cost, low maintenance cost, Low operation cost. There is two type of mechanism is available for release the dust which is collect by bags which is mounted in dust collector for collecting dust coming from blasting chamber. Shaker mechanism & Air blast mechanism

F. Inlet Ducting: Inlet ducting is a simply piping which is come from blasting chamber to dust collector as shown in figure 1

G. Outlet Ducting: Inlet ducting is a simply piping which is come out from dust collector and go to blower as shown in figure 1

H. Elevator: The circulation of the abrasive agent involves two stages. The first stage begins in the hopper placed on the highest level in the shot-blasting machine. The hopper has two functions: it holds the required amounts of the abrasive agent to ensure the continuity of the process and acts as a dosing unit, supplying the shots to the blasting turbine through the action of the gravity force via a piping installation. The characteristic parameter in the dosing process is the concentration of the shot column, which determines the amount of shots and the dynamics of their flow to the turbine [1].

III. Typical Shot Blasting Cycle

Process is start with the feeding a shots in the blast wheel and blast wheel convert electrical energy in to kinematic energy by rotating turbine wheel of shots. This process is continues until get require surface finish.

- Used shots are collect by conveyer system at the bottom of the chamber and again it fed to blast wheel by Elevator.
- Separation system is separate the damaged shots in the elevator.
- Other side dust collector is working for collecting a dust which is generating during shot blasting process in a chamber.
- Blower is sucking a dust by air from the shot blasting chamber.
- Mixture of dust and air is entering in the dust collector by inlet ducting.
- Mixture is pass through a bag arrangement ,in which air is pass through it and pure air is come out through blower and dust are collect in the bag.
- After completing one cycle of the process, shaker mechanism is shaking bag arrangement, due to shaking dust come out which is collected in bags and collect in the container which is provided at the bottom of the dust collector.

IV. Classification

Figure 3 shows broad classification of the shot blasting process

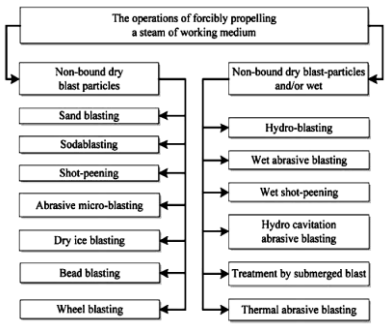

Fig. 3: Classification of Shot blasting process

A. Dry-Blasting: Involve two methods used for dry-blast cleaning; mechanical blasting and air pressure blasting.

B. Mechanical Blasting: Most frequently employs the use of cabinet-type equipment. It is available in either batch, semi-automatic or automatic versions. Typically, the cabinet houses one or more blast wheels which direct the abrasive at the workpiece by centrifugal force.

C. Air Pressure Blasting: uses compressed air to apply abrasive to a surface. Air pressure blasting uses either a direct pressure or an induction method that may use either the siphon or gravity method [6].

D. Wet Blasting: involves high velocity, compressed air propulsion of slurry directed onto a workpiece. The slurry normally consists of fine abrasive suspended in chemically treated water. It usually is kept in continuous agitation to prevent settling of the abrasive [6].

V. Work Handling Systems In Blasting Chamber

Constructional and operational parameters of shot-blasting machines are closely related to the efficiency of the shot-blasting operation [1]. In every shot blasting process it is necessary to expose all the surface of all the components which is going to process. Mostly shot blasting machines are classified according to their handling system. Some of them are discussed below.

A. Swing table blast clean machine

These units are larger in dimension and are more heavily constructed than cabinet machines. Most operate on the centrifugal wheel principle and employ timers and automatic shut-off controls to provide the desired amount of abrasive exposure. A workpiece can be placed on either a rotating table or an endless revolving belt that tumbles the job to expose all surfaces to the abrasive. Machines are loaded either mechanically or manually depending on the weight of the job. On tumble blast machines, belt travel can be reversed to automatically unload cleaned parts into tubs or skips. Rotating table machines are used to clean very large parts. The table can be swung in and out of the enclosed blasting chamber to facilitate loading and unloading [6].

B. Tumblast shot blasting machine:

Fig. 4: Tumblast Machine [11]

A product of company is shown in Fig 4 Its brand name is Tumblast and operates with mill-construction mechanism. It is classified by its application, Super tumblast and ultra tumblast. Super tumblast is for batch production and ultra tumblast is for continues process. In both of them mill structure is same for toppling the components [8]

VI. APPLICATIONS

- Clean a surface by removing unwanted rust, scale, paint, etc., in preparation for painting, anodizing, welding, or other processes which require a clean surface.
- Deburr, remove tooling marks, or otherwise finish a crude product.
- Change metallurgical properties or stress relieve a part by the peening action of multiple impactions.
- Produce a desired matte or decorative finish.[6]
- Micro blasting of cutting tips and tools is a very effective and reliable method of advancing the life of tools under the action of turning, milling, drilling, punching and cutting.[7]

VII. CONCLUSION

The tumblast machines work with mill construction. From the figure 4 it is seen that in the mill construction, flights are fitted on the conveyor with fasteners. Space is required between two flights due to arrangement of rolling conveyor for tumbling the components. Because of the space components with thin section may trap between two consecutive plates. This not only hinders movement of belt, but also reduces life of mill. Eventually it leads to early failure of the mechanism. Each failure cause substantial loss of production as it takes 2 – 3 days to replace the damaged portion. Hence there is an acute need of new system/mechanism. The new mechanism should be able to fulfill functional requirements of the existing mechanism and has to offer greater reliability. This can be achieved by designing a system which requires less number of parts. So this also becomes a design constraint for new mechanism. Also along with the new system, subsystems should also be design

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