Motorized Movable Platform Mounted on Ladder for AOD Fixed Duct Maintenance

Ajay Rathna Kumar A1, Ajith Abinash S1, Aravind Kumar U1, Arulmurugan R1, Santhosh Kumar S2

1 Department of Mechanical Engineering, Sri Krishna College of Technology, Coimbatore.
1 Assistant Professor, Department of Mechanical Engineering, Sri Krishna College of Technology, Coimbatore.

ABSTRACT
In an industry, Maintenance is required to effectively reduce waste, run an efficient and continuous manufacturing operation. The cost of regular maintenance is very less when it is compared to the cost of a major breakdown at which time there is no production. Regular maintenance accomplishes many of the most important maintenance objectives including preventing outages, increasing safety, maximizing equipment life and lowering overall maintenance costs. Maintenance of Industry equipment in places like high height, not done by men and not accessible for maintenance tool is very risk and difficult too. Maintenance job in such area leads to increase of time consumption, cost, number of labors required and also it has life risk. In such case we need to provide alternate way of maintenance method to reduce those difficulties. In our project we have provided alternate solution for the problems faced in AOD (Argon Oxygen Decarburization) fixed duct maintenance. AOD is a unit in Steel Melting shop at Salem Steel Plant. Previously, for maintenance of AOD unit they have to rope the ladder at the height of 16ft from the ground and the labor has to climb the ladder and do the job. The size of AOD fixed duct is about 3 meter in diameter so approaching for maintenance job is very difficult. To overcome these difficulties, we have proposed an idea called “Motorized movable platform mounted on boom” such that the labor can comfortably work by standing on platform and the platform mounted on ladder goes inside and comes outside by motor mechanism.

Keywords: Manufacturing, Steel Plant, Motorized Movable Platform, Industry Equipment

1. INTRODUCTION
Steel Authority of India Limited (SAIL) is the largest steel-making company in India and one of the seven Maharatna’s of the country’s Central Public Sector Enterprises. SAIL produces iron and steel at five integrated plants and three special steel plants, located principally in the eastern and central regions of India and situated close to domestic sources of raw materials. SAIL manufactures and sells a broad range of steel products. The Government of India owns about 75% of SAIL’s equity and retains voting control of the Company. However, SAIL, by virtue of its ‘Maharatna’ status, enjoys significant operational and financial autonomy. The Salem Refractory Unit of Burn Standard Company Limited (BSCL) became a wholly-owned subsidiary of SAIL. The unit has now been renamed as SAIL Refractory Company Limited (SRCL). In 1976, the Government of India took over BSCL as a subsidiary of Bharat Nigam Limited under the administrative control of the Ministry of Heavy Industries. Soon after, BSCL underwent a modernization & expansion programme in order to meet the growing demand of high quality basic refractories in the modern steel plants of SAIL and other private sector steel processors of non-ferrous, cement and glass industries. Since refractory
material is a critical input required for iron & steel plants based on the basic oxygen furnace route, SRCL’s merger with SAIL is expected to go a long way in ensuring mutual benefit and growth. Salem Steel Plant, a special steels unit of Steel Authority of India Ltd, pioneered the supply of wider width stainless steel sheets / coils in India. The plant can produce austenitic, ferritic, martensitic & low-nickel stainless steel in the form of coils & sheets with an installed capacity of 70,000 tonnes / year in Cold Rolling Mill & 3,64,000 tonnes / year in Hot Rolling Mill. Its steel melting shop can produce 1,80,000 tonnes of slabs per annum. In addition, the plant has country’s first top-of-the-line stainless steel blanking facility with a capacity of 3,600 tonnes / year of coil blanks & utility blanks / circles.

Fig.1.0. Industrial Layout

In Scrap unit a lot waste metals, scraps were collected from various places and it is stored. Then it is handled by cranes to load and transfer it to the Steel melting shop. In this unit there are two overhead cranes by which the tones of scraps were handled. Steel Melting Shop produces stainless steel slabs. (Thickness is 145mm AND 175mm and width 600mm to 1300mm). Its rated capacity is 1, 80,000 tonnes/annum. The steel melting facilities comprise ultra-high-power Electric Arc Furnace, Argon Oxygen Decarburising (AOD) Refining Unit with Level-II automation, Ladle Furnace & Continuous Casting machine with state-of-the-art technology to produce premium quality stainless steel slabs. Hot rolling mill produces hot rolled carbon and stainless-steel coils. (Thickness range is from 2mm to 12.7mm mild steel). (2.5mm TO 8mm stainless steel). Its rated capacity is 3,64,000 tonnes / annum. Hot Rolling Mill complex is equipped with walking beam reheating furnace, primary descaler, 4-hi reversing roughing mill, 4-high reversing Steckel Mill, down coiler, laminar cooling & roll grinding machines, procured from world renowned suppliers. The Steckel Mill, the mother unit of hot rolling with level-2 automation is provided with hydraulic gauge setting & automatic gauge control. Cold rolling mill produces Cold rolled stainless steel coils and sheets. (Thickness range is from 0.3mm to 6mm). Its rated capacity is 1,86,000 tonnes / annum. Cold Rolling Mill complex is equipped with the most modern stainless-steel production lines, sourced from leading manufacturers of the world. Coil build up line, bell anneal furnaces continuous annealing & pickling lines, Sendzimir mills, skinpass mill, strip grinding line, slitting & shearing lines to produce coils /sheets with precise dimensional tolerance & flatness with superior metallurgical characteristics. Additionally, it has a blanking unit to produce Coin blanks and utility blanks. Its rated capacity is 3,000 tonnes / annum. Blanking is a metal fabricating process, during which a metal work piece is removed from the primary metal strip or sheet when it is punched. The material that is removed is the new metal work piece or blank.
2. LITERATURE SURVEY

James P. Lewis et al., [1] disclose a motorized ladder hoist with an adjustable carrier platform that “pivots to horizontal position when the carriage reaches the top.” The ladder hoist is winch operated and contains wheels at the bottom of the ladder to ease transportation to and from a work site. The carrier platform of the hoist travels on rollers along the channel tracks of the ladder. The carrier platform further makes use of stakes to help secure the loads in place during movement up or down the hoist. Frank A. Mitchell et al., [2] disclose a ladder stabilizing device that attaches to the tracks and rungs of a ladder to secure the ladder to the rooftop of a building while also protecting the edge and/or gutters of the roof from damage that could be caused by the ladder. The stabilizing device disclosed in the '356 patent teaches extending a ladder away from the roof through the use of a pair of extension arms that connect to a pair of adjustable support arms that attach to a flat support platform designed to be in contact with a roof. Wilhelm Albert et al., [3] disclose that the wire ropes are stressed by fluctuating forces, by wear, by corrosion and in seldom cases by extreme forces. The rope life is finite and the safety is only ensured by inspection for the detection of wire breaks on a reference rope length, of cross-section loss, as well as other failures so that the wire rope can be replaced before a dangerous situation occurs. Installations should be designed to facilitate the inspection of the wire ropes. Lifting installations for passenger transportation require that a combination of several methods should be used to prevent a car from plunging downwards. Elevators must have redundant bearing ropes and a safety gear. Ropeways and mine hoistings must be permanently supervised by a responsible manager and the rope must be inspected by a magnetic method capable of detecting inner wire breaks. The end of a wire rope tends to fray readily, and cannot be easily connected to plant and equipment. There are different ways of securing the ends of wire ropes to prevent fraying. The most common and useful type of end fitting for a wire rope is to turn the end back to form a loop. T R Barnard et al., [4] In principle, spiral ropes are round strands as they have an assembly of layers of wires laid helically over a centre with at least one layer of wires being laid in the opposite direction to that of the outer layer. Spiral ropes can be dimensioned in such a way that they are non-rotating which means that under tension the rope torque is nearly zero. The open spiral rope consists only of round wires. The half-locked coil rope and the full-locked coil rope always have a centre made of round wires. The locked coil ropes have one or more outer layers of profile wires. They have the advantage that their construction prevents the penetration of dirt and water to a greater extent and it also protects them from loss of lubricant. In addition, they have one further very important advantage as the ends of a broken outer wire cannot leave the rope if it has the proper dimensions. Lewis, M. J. T. et al., [5] Helical or "dry fixed" gears offer a refinement over spur gears. The leading edges of the teeth are not parallel.
to the axis of rotation, but are set at an angle. Since the gear is curved, this angling makes the tooth shape a segment of a helix. Helical gears can be meshed in parallel or crossed orientations. The former refers to when the shafts are parallel to each other; this is the most common orientation. In the latter, the shafts are non-parallel, and in this configuration the gears are sometimes known as “skew gears. The angled teeth engage more gradually than do spur gear teeth, causing them to run more smoothly and quietly. With parallel helical gears, each pair of teeth first make contact at a single point at one side of the gear wheel; a moving curve of contact then grows gradually across the tooth face to a maximum, then recedes until the teeth break contact at a single point on the opposite side. In spur gears, teeth suddenly meet at a line contact across their entire width, causing stress and noise. Spur gears make a characteristic whine at high speeds. For this reason spur gears are used in low-speed applications and in situations where noise control is not a problem, and helical gears are used in high-speed applications, large power transmission, or where noise abatement is important. The speed is considered high when the pitch line velocity exceeds 25 ms.

3. DATA ANALYSIS

Regarding the root causes further we collected data and we concluded that the grinding and welding activities consumes more time.

Fig.3. Data Analysis Graph for Hood Repair

4. SELECTION OF EFFECTIVE SOLUTION

From these three alternate solutions, to select a suitable one, feasibility study was conducted ‘through L-Matrix’

❖ In the feasibility study for shifting and keeping the duct in floor level, it needs more time, external agency helps and unsafe so the idea was dropped.
❖ The idea of ladder with locking basket may seems good, but here also unsafe activity involves during change of basket position and locking, also more man power and time required so we dropped this idea.
❖ Pulley with wire rope Sliding type up/down mechanism gets higher score, because of ease of handling, less time taken and more secure, so we selected the solution.

By considering all these feasibility factors we have concluded that we have to choose Alternate solution No.3 “PULLEY WITH WIRE ROPE SLIDING TYPE UP/DOWN MECHANISM”.

5. DESIGN OF SOLUTION
2D drafting and drawing is the process of creating and editing technical drawings (US site), as well as annotating designs. Drafters use computer-aided design (CAD) software to develop floor plans, building permit drawings, building inspection plans and landscaping layouts. CAD software for 2D drafting can be used to draft designs more quickly and with greater precision, without using stencils and technical drawing instruments. 2D CAD software also allows users to document and annotate drawings with text, dimensions, leaders and tables. We have designed and drew the idea we have proposed such that we can express our Brainstorming idea in a proper way. We have used AUTOCAD.

Hence the proposed solution of the problem satisfies all the requirements of the project objective, the feasibility, effectiveness of the solution is discussed and approved by the industry, as it is an effective solution for the problem and it will be implemented in the industry. As the project objective is to "solving the most affected problem faced by the employees with ensure of their safety, time and also the consideration of industry’s feasibility, by implementing an effective solution of the problem, which is to be highly reliable for the industry, accessible for the employees, reduces the chance of risk, ensures the employee safety, and to save time and cost" so the conclusion of the project output, solution satisfies the main project objective.

6. CONCLUSION

Fig.5. 2D Drawing

REFERENCE


