

## **Crane for Maintenance of Potroom Building Rails**

**Jasbant Pradhan, Krishnan S. Kumar**

Emirates Global Aluminum Jebel Ali, Dubai, United Arab Emirates

Corresponding author: jpradhan@ega.ae

### **Abstract**

In aluminium smelters crane is essential and critical equipment which is used in the potrooms for multiple operations such as metal taping, anode setting, beam raising, etc. The crane moves on building rails that need periodic maintenance for continuity and safety of operation. The overhead multipurpose potroom crane or pot tending machine (PTM) moves in a straight line on the rails. To inspect the rails inside the potroom requires, isolation of the potroom crane's down-shop conductor, which restricts the crane movement and thereby the potroom operation in that section. The method used earlier required skills and high coordination between the team members carrying out maintenance on the building rails. There are potential hazard associated with this method such as falling from height, slipping, tripping, electrocution, dust, fumes and heat. We have developed an inspection crane used to overcome the potential hazards associated with previous method.

### **1. Introduction**

In aluminium smelters, many types of overhead cranes are used for various applications such as cathode replacement, beam raising, anode setting, metal tapping, etc. These cranes run on potroom building rails. These rails are fixed onto the potroom building structure with clamps secured by bolts. Due to continuous operation and movement of cranes over these rails, the clamps and bolts become loose or worn out and they requires replacement and maintenance of the rail track.

### **2. Present Situation and Practice**

The rail track (Figure 1 and Figure 2 left) is from 160 to 800 meters long and runs along several sections in a potroom. To carry out inspection and maintenance job on the two sided building rails, the power should be isolated in the section so as to avoid crane movement and electrocution from crane's power rails, mounted along the building beam above the rail. However, electrical hazards of bridging between pot potential and earth potential still exist as pot ducts up to the insulation sleeve and superstructure are at pot potential but the exhaust duct on the building side, the building and the crane rails are at earth potential (Figure 3). The difference between the pot and the earth potential can be as high as the potline voltage, depending on where the electrical 'null point' of the potline is [1].

The inspection procedure requires high skill forklift operator and high level coordination between eight employees carrying out the maintenance work. Walking on a narrow beam with harness hooked on the life line still has the risk of slip and trip. Two forklifts, with the man lift wooden basket electrically insulated, are required to carry out the job, one on each side of the potroom building for faster maintenance in the isolated section. High risk of electrocution from nearby differences in electrical potential still exists at the duct end of the superstructure where the structure is electrically isolated as shown in Figure 3.

In EGA Jebel Ali crane maintenance team carries out building rail inspection periodically and does the repair work accordingly. The task to be carried out inside the pot rooms at height involves the following:

- Two forklifts with wooden staging,
- Eight technicians to carry out the task,
- Isolation of the down-shop conductor of the potroom crane,

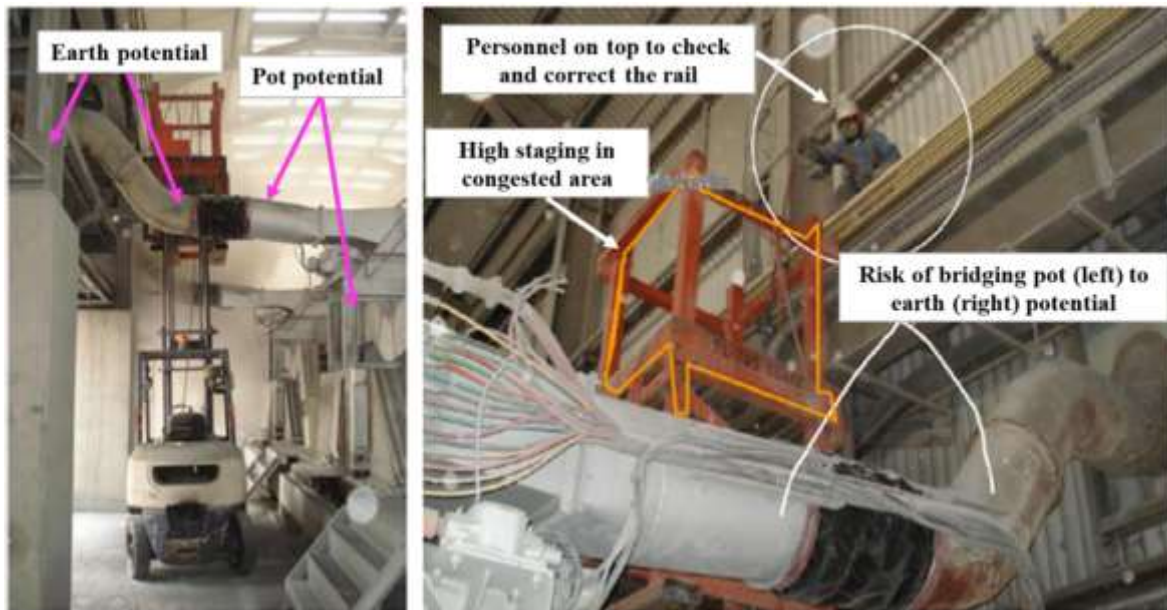
- Building life line (this is a cable rope fixed on the building, used to hook the safety harness to safeguard in case of fall from height; periodic inspection and certification of life line required).
- High level of coordination between the forklift operators and personnel working on the wooden basket, lifted by forklift as shown in Figure 3.
- Personnel inspecting the building rails have to walk on narrow passage at a height (approximately 5 - 6 meters above the potroom floor).
- For critical operation requirement, crane availability will be delayed due to de-isolation process and transfer of crane from another section.
- Time consumption in isolation and de-isolation process along with crane transfer (minimum 1 - 2 hours).



**Figure 1. One of the potroom cranes in operation, the picture shows building rail.**



**Figure 2. Building rail and associated hazards (dust and fumes).**



**Figure 3. These pictures show work in progress by the old method.**

The inspection and maintenance require minimum 8 - 12 hours per sections due to:

- Multiple up-down operation of the man-lift wooden basket using the forklift,
- Many pneumatic hose connections and changes in location,
- Narrow passage on the duct side slows down the forklift movement,
- Dust and heat makes the personnel tired and increases the risk of heat related illness.

### **3. The Invention**

A decommissioned potline construction crane was sitting in the courtyard and we had the idea that this crane could be modified and dedicated for the potroom crane rail maintenance work. The crane was modified with all the inventions, described below and certified by Carl Stahl, who still certifies the crane periodically. Figure 4 shows the modified crane.



**Figure 4. Building rail inspection car parked in crane maintenance bay.**

The features of the new rail inspection crane are:

- Four-sided man carrying baskets with safety harness hook points for maintenance personnel (Figure 5, left),
- Tool box and storing boxes for clamps and bolts,
- Anti-collision sensors,
- Air compressor for pneumatic tools used in maintenance jobs, such as pneumatic wrench tools,
- Vacuum machine installed on the rail inspection car to clean the alumina/dust deposited over the rails (Figure 6, left),

- Air conditioned unit installed and cooling ducts laid up to man-carrying basket (Figure 5, right),
- Rail cleaning brushes installed on the car,
- One pendent with festoon cable arrangement to operate the inspection car for both A and B room,
- Emergency stop push button installed in each man-carrying basket,
- Audio alarm installed for communication between operator and the maintenance personnel on the car (Figure 6 right),
- Separate audio alarm to indicate crane movement,
- Variable frequency drive installed for smooth acceleration (Start) and de-acceleration (Stop) of the car,
- Certified and used in multiple projects, minimizing the cost and time.

The new crane in use for the potroom rail inspection and repair is shown in Figures 8 and 9. Beside the usage of the crane by EGA maintenance teams, it has been also used by Fives ECL and Rapid Rail for some potroom projects.



**Figure 5. Left: man-carrying baskets, Right: air conditioning system.**



**Figure 6. Left: vacuum system, Right: power tool air outlets.**



**Figure 7. Left: safety stop and horn, Right: visual and audio alarm.**



**Figure 8. Rail inspection car being used in one of the section for rail inspection.**



**Figure 9. Picture shows maintenance crew using pneumatic torque wrench for tightening and replacement of rail clamps.**

#### **4. Benefits**

The use of the new rail inspection crane saves time and money in various projects and in periodic inspection and maintenance of potroom building rails. The innovative idea to refurbish a decommissioned crane for the potroom has multiple advantages listed below:

- Carrying out the task with ease
- Saves time, manning and avoids delays in potroom operation,
- Reduces the risk of falling from height and of dust, fumes and heat exposure,
- Avoids isolation/de-isolation of down-shop conductor,
- Ensures potroom crane availability to attend emergency,
- Recovers and recycles collected alumina,
- Improves quality of work and efficiency due to available spares and pneumatic line on the crane,
- Maintenance job can easily be carried out during idle section without affecting potroom crane movement,
- Several EGA suppliers have used the car for different projects.

#### **5. Conclusions**

The invention and method developed to carry out building rail inspection and repair not only reduce the maintenance hours but also improve safety at work and reduce the associated electrical hazards. The rail inspection crane invented, is also used for various engineering projects, such as installation of building life line and inspection and repair of building beams. The new crane saves cost and time.

#### **6. Reference**

1. Vinko Potocnik and Abdalla Al Zarouni, Review of electrical safety in potrooms, 32<sup>nd</sup> *International ICSOBA Conference & Exhibition*, Zhengzhou, China 12 – 16 October 2014, Paper AL-10.