

Design and Fabrication of Fixture for Changing the Crane Tong Jaw Bit

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Abstract—Slabs are unloaded and charged in reheating furnace using cranes in the slab yard area. Slab yard crane have jaw bits in each corner to grip the slab during loading and unloading. Due to prolonged usage, the tong jaw bits get chipped off or worn out. So it is replaced with salvaged one. By continuing the crane operation without changing the worn out jaw bits, as it may lead to slab falling due to poor grip. Five employees are required to lift, position and change the worn out tong jaw bits. It takes more time due to inherent size. To reduce the man power, time consumption and eliminate demurrage a fixture is designed and fabricated for changing the worn out jaw bit.

Keywords— jaw bits; crane; worn out; fixture

1. INTRODUCTION

The slabs are unloaded from railway wagon by using the crane. The purpose of crane is very important in hot rolling mill slab yard area. By continuous usage of crane, the tong jaw bit is worn out due to the heavy load of slabs. So we need to change the worn out jaw bits. The worn out jaw bit will rework for reuse. It takes more time and more than five employees to lift and align the jaw bits. Soit causes demurrage. The term demurrage refers to the amount paid for extra usage of railway wagon for loading and unloading the slabs.

The causes were identified while analysing the selected problems.

- Unsafe condition and improper access.
- There is no equipment for changing the jaw bit so it is complicated to change.
- Mismatching of jaw bit will causes accident.
- Handling of jaw bit is very difficult due to heavy load.
- Utilizing of man power is more so it may causes demurrage.
- Time consumption is more.
- It will damage the slab material and slab yard as well as railway wagon when unloading.

A. Fixture

Fixture is a work holding device that is bolted or otherwise fastened to the machine table. A fixture does not provide guidance for work tool. Provisions are usually made for setting up the tool in the specific surface, called rest surface on the part. The device used for this purpose

is called as set block. Rest surfaces or locating pins on the set block allows each duplicate part to be positioned and clamped to the fixture in the same manner so that the operation taking place will always be within the same dimensional tolerances.

2. CRANE

Crane is used for moving heavy objects in both vertical and horizontal direction. Crane capacity range starts from a few hundred kilograms to several hundred tones; motive power may be furnished by hand, by steam or internal-combustion engines, or by electric motors. In form, cranes are classified as jib, derrick or bridge.

An overhead crane, commonly called a bridge crane consists of a horizontal beam, running on tracks at both ends for longitudinal motion and carrying a trolley running on the beam for lateral motion. The ordinary bridge crane runs on elevated tracks, while the gantry crane is mounted on legs that run on tracks at ground level.



Figure2.1

A. Tong

Tong is an instrument was fixed in the crane with two hinged or sprung arms for grasping and holding the object. It carries the slab for moving one place to another place.

Types of lifting tongs

1. Supporting tong
2. Gripping tong
3. Pressure tong

Pressure Tong

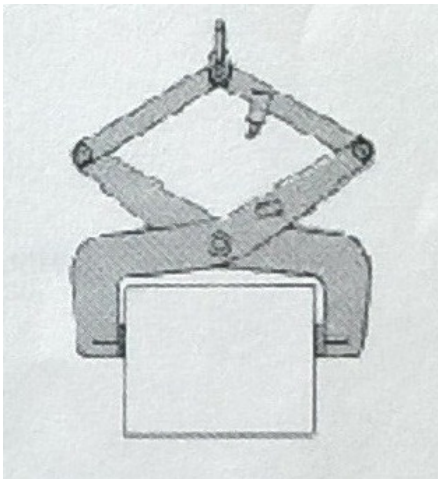


Figure 2.2

Pressure tongs grip the vertical sides of slabs, bales, boxes, billets and other flat or round objects. Pads on pressure tongs provide surface friction or penetration of the load to maintain a safe hold during handling. Pads can come with rubber, belting, pins, points, serrated bits and other materials, depending on the coefficient.

B. Jaw bit

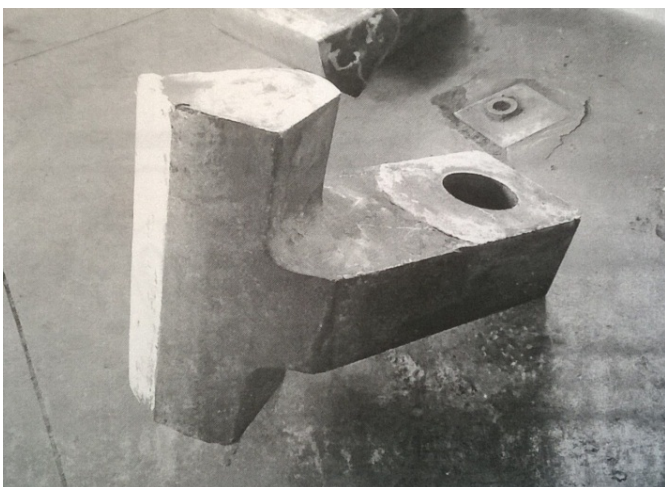


Figure 2.2

It is nothing but, either of two hinged joint parts of tool or machine used to grip the object securely. In the motorized slab tong the jaw is present at the end of gripper; it is used to gripping the slab for unloading purpose. So it causes wear and tear during process because of heavy loads of slab then the jaw bit can be removed, salvaged and used it again.

3. COMPONENTS USED

A. Round steel pipes

The round steel pipes are used most widely in construction industry. According to the different applications, the round steel pipes have different diameters. These pipes can be customized easily. These steel pipes are available in different thickness, diameter, length and quality. Generally, these rounded steel pipes are high corrosion resistance, high reform able, toughness, and higher strength.

While measuring the diameter of a round steel pipe, the outside as well as the inside diameters should be measure separately. The thickness of these pipes are determines the pipe size. Here we are using 20mm outer and 14mm inner diameter steel pipes for construct the main frame of the fixture.

B. Steel plate

Steel plate have $\frac{1}{4}$ inch to 13 inches in thick. Usage of steel plate can be welded, cut, heat treated and subject to other processes. These properties make it a valuable manufacturing item used in many industries.

This steel plate is welded in the frame of the fixture by arc welding and is used to carries the jaw bit.

4. OPERATION PERFORMED

1. Designing
2. Analysing
3. Shearing
4. Pipe bending
5. Welding

A. Designing

Design, creating an object's form and function. Design can involve products, machines and structures that serve their intended purpose and are pleasing to the eye as well. For designing the fixture component we are using CAD & PROE software's.

B. Analysing

Analysis is general term that refers to systematic examination of the nature or cause of something. The development of modern science has created several specialization form of analysis. For analysing the fixture component there is using the Ansys software.

C. Machining

Cutting is a collection of processes wherein material is brought to a specified geometry by removing excess material using various kinds of tooling to leave a finished part that meet specifications. The net result of cutting is two products, the waste or excess wood. In cutting metals the waste is chips and excess metal. These processes can be divided into chip producing cutting, generally known as machining.

D. Welding

Welding, in engineering, any process in which two or more pieces of metal are joined together by the application of heat, pressure, or a combination of both. Most of the processes may be grouped into two main categories: pressure welding, and heat welding. In pressure welding the weld is achieved by pressure and heat welding the weld is achieved by heat. Heat welding is the most common welding process used today. The round steel pipes and steel plate are joined by using the heat welding process.

5. WORKING

At last the fixture for the crane tong jaw bit changing component, will be made according to our need by various operation that have been mentioned above in “operation performed”. During the change of jaw bit the fixture must be placed at the bottom of the motorized duplex tong with a certain height of distance. Then the jaw bit is placed into the fixture according to the correct position. The crane tong is moved downward to the ground level and the fixture is adjusted front and back by steel rod with respect to crane tong. The angle of jaw bit is adjusted for matching the hole of tong and jaw bit by adjusting the steel rod, and then the second person will engage the jaw bit with tong by a pin. The same procedure is repeated for changing other three jaw bits. Then the fixture is removed safely. All the above operations will be done within a few minutes by two workers.



Figure 5.1

6. DESIGN AND ANALYSIS

Isometric view of fixture



Figure 6.1

Two dimensional view of fixture

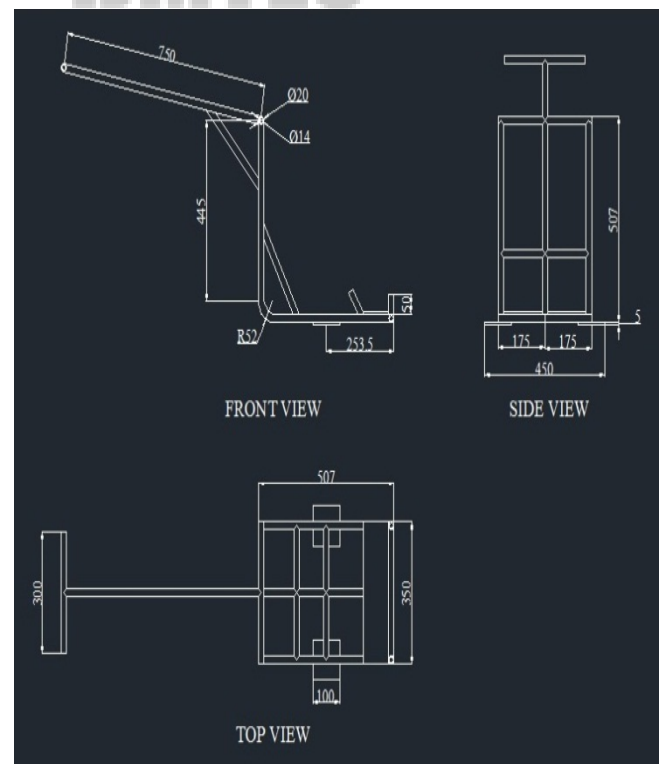


Figure 6.2

Total deformation for fixture

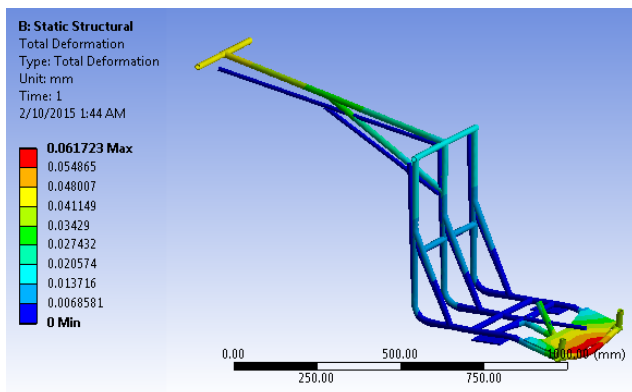


Figure 6.3

7. MERITS

- Time consumption is very less.
- Reduced man power from five to two.
- The cost of fixture is very less.
- It is very compact and portable one.
- It is too easy to handle.
- It prevents accidents in the slab yard during unloading.
- It creates better and safe working practices.
- It will help to avoid demurrage.

8. CONCLUSION

This project implementation is used to reduce the man power and simplify the operation of changing jaw bits. So it will reduce the risk happens while loading unloading. Moreover, the demurrage will be avoided. So it is useful for saving time and cost as well as man power.

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